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IMPROVED STEAM STREET CAR.

For suburban traffic, particularly where large numbers of excursionists are to be carried short distances to and from pleasure resorts, as between Brooklyn or Bay Ridge and Coney Island, the American practice is to use light cars, with or without steam motors. The advantage gained by the utmost lightness of construction consistent with strength arises from the relatively small weight of material for each passenger, the extra cheapness and durability of light cars, and the easy adjustment of dead weight to the traffic. This is particularly important where the traffic is irregular in quantity. When the rush of passengers is great, the additional capacity required is easily obtained by adding cars, which may be dropped when the rush is over.

The European practice is in many respects quite different. For the suburban traffic of Berlin, for example, the cars are much heavier than American cars for similar work, and usually are double deckers. Several attempts have been made in this country to introduce two-story cars for street service, but in no case has the attempt been long persisted in. The general verdict is that they are not profitable. What the secret of the success of such cars in Europe may be, we are not prepared to say; yet it is evident that they are successful and apparently popular. The illustration presented below gives a good idea of one of the most approved forms of such double cars. It is said to be specially adapted for short suburban roads and for connecting pleasure resorts. The car can be detached from the locomotive, but generally they remain together. The engine, which is capable of hauling two or more cars, has two seven-inch cylinders with twelve-inch stroke, and can develop 100 horse power. It has a speed of 38 miles, and may be quickly stopped and started. It burns from 5 to 6½ pounds of coal per mile, and can carry fuel for a run of 125 miles and water enough for 50 miles. The ground floor of the car has seats for 20 first and second class passengers, and 20 third class; the upper story has 40 third class seats. There is also standing room for ten or twelve passengers, space for baggage, a closet for mail bags, two drop-boxes for letters, a closet for the conductor and another for tools and implements. The car is heated by steam, and is provided with both hand and steam brakes.

These cars and locomotives were designed by C. Thomas, civil engineer in Mainz. The special advantage claimed for them is their comparatively low cost, making them economical for roads having no very great traffic and unable to afford a large amount of rolling stock.

Where passengers are separated into classes paying different rates, the two story arrangement seems to answer very well. On American roads a few smokers might be induced to climb to the upper compartment, but the multitude would not willingly take to them. At least, that has been the experience wherever double deckers have been tried here.

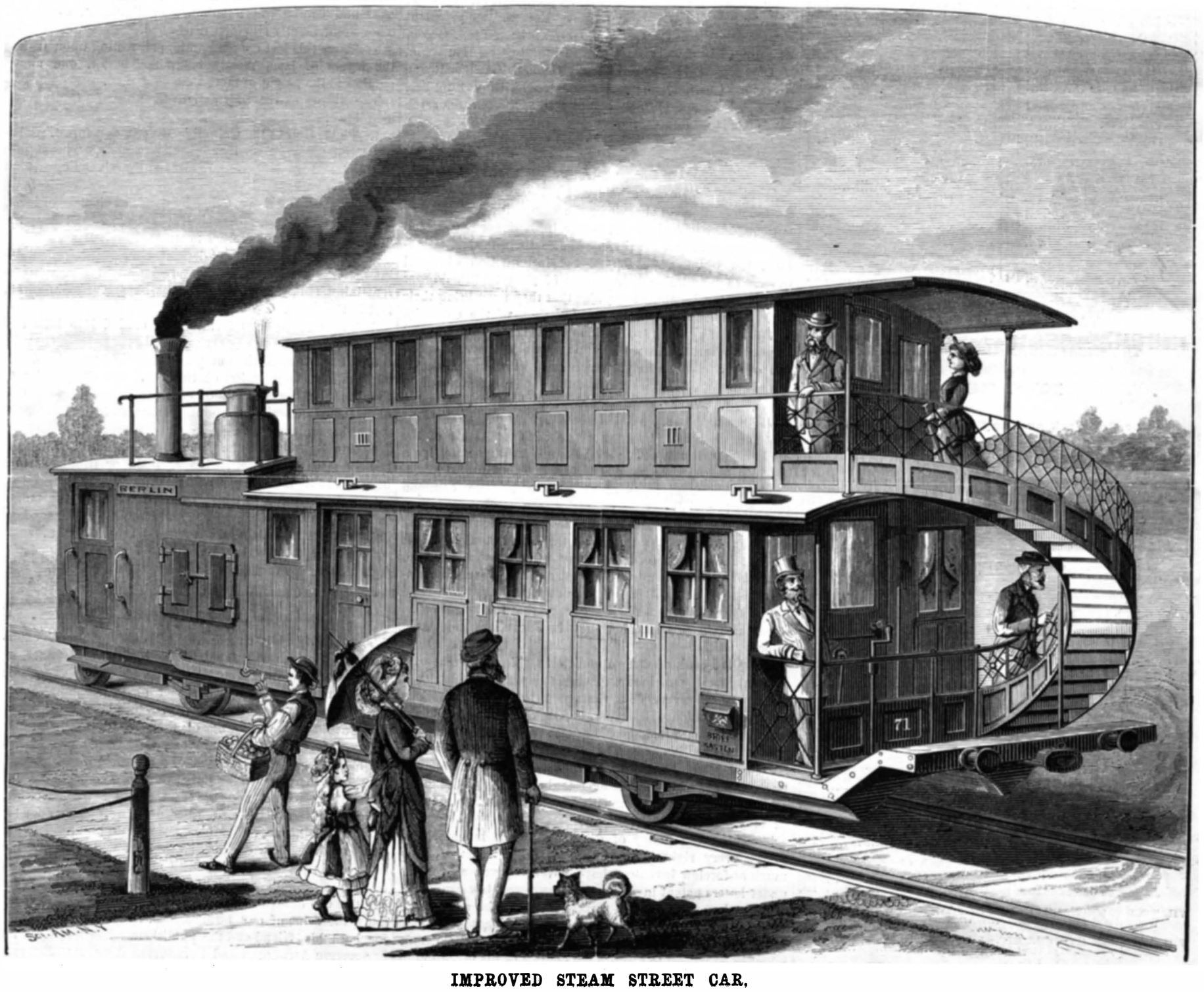
How Hinges and Other Articles are Polished.

Common articles of hardware such as screw eyes, hinges, handles, etc., are polished by tumbling in a revolving barrel. The tumbler is charged about half full with the goods mixed with the material selected according to experience as best suited to do the work. Small scraps of iron, sand and gravel with the attrition of the metal take away the roughness and put a moderately smooth surface to the work. Then charge the work into a tumbler partly filled with leather scrap or skivings cut fine, mixed with crocus or almost any fine polishing powder; after which it can be cleaned and brightened by an additional tumbling in sawdust and lime. The above is a general feature of this kind of work. Almost every manufacturer has some peculiar system of management suited to the special kind of work made. Some use oil or water, then boil the work in lime water, and again tumble in saw dust to dry and brighten. The black oxide of iron (anvil scales) is much used where it can be had. A little plumbago is sometimes thrown into the tumbler to give the work a shining black surface. A strong barrel or keg on trunnions with a small door for charging is the most suitable for small, light work.

Much work that has a fine finish upon the surface is polished by boys, who handle the individual pieces against a large brush wheel with crocus or whiting. With a large wheel, the process is so quick that a boy will run through with many thousand pieces in a day.

A New Balloon Project.

M. Tissandier, the French aeronaut, is projecting the manufacture of an elliptical balloon, which is to be driven by a dynamo machine and storage batteries. The balloon will be 131 feet long, and will have a capacity of more than 100,000 cubic feet. It is calculated to give a lifting power of 3½ tons, which will, when the machinery is in place, allow for a ton of passengers and ballast.



IMPROVED STEAM STREET CAR.

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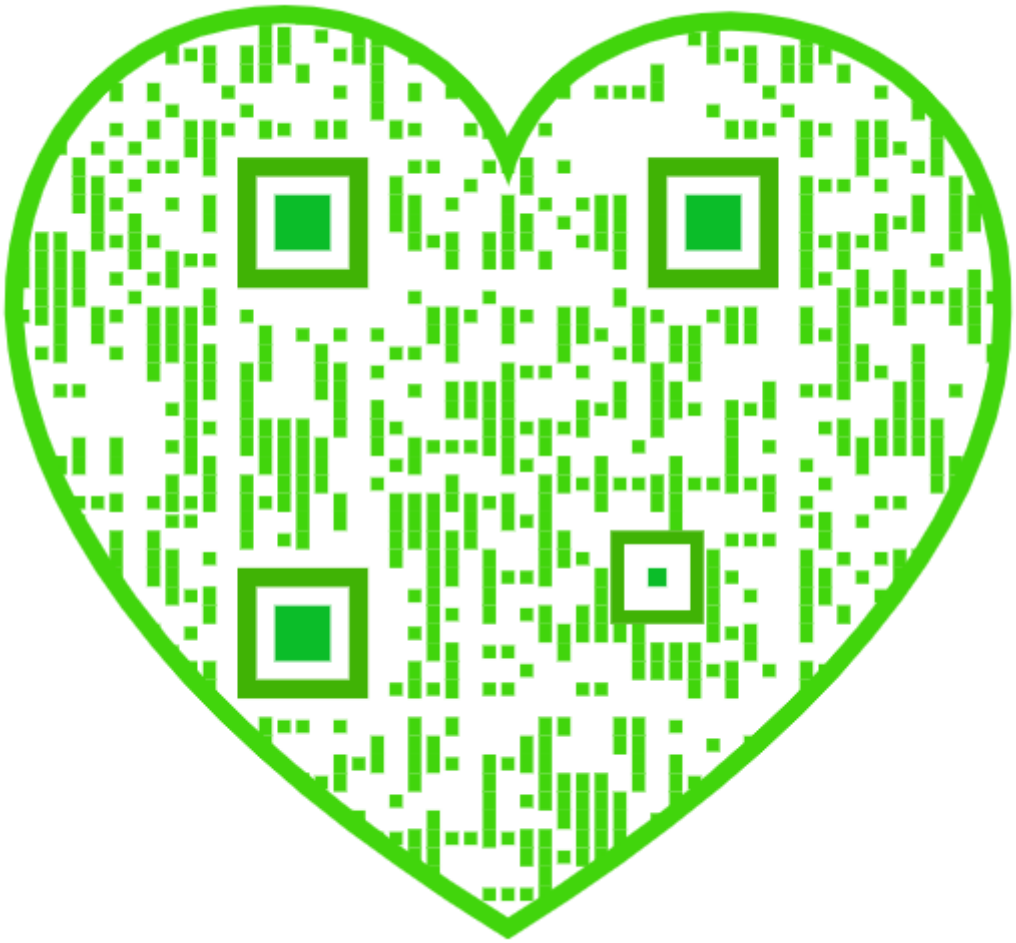

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NATIONAL EXPOSITION OF RAILWAY APPLIANCES.

The Board of Commissioners of the proposed national exposition of railway appliances have issued a circular announcing that they have secured for the purposes of the exhibition the Inter-State Exposition buildings, in Chicago; and that their intention is to hold the exhibition during June and the fore part of July, 1883. A large guarantee fund has already been raised in Chicago.

The buildings named are said to be the largest of the kind in the country. The main building is 800 feet by 200 feet. It has a capacious gallery one-third of a mile long, and is provided with an abundance of steam power for operating machinery. Railway tracks will be laid the entire length of the building for the accommodation of locomotives and cars and for use in making tests.

The Board announce also that a series of scientific and practical tests, to be made by well-known scientists and carefully selected committees, extending to every article and every description of material susceptible of reliable test, will constitute one of the most interesting as well as most valuable features of the exposition. An official record of these tests and of every exhibit, including a list of prizes awarded, will be made and published under direction of the Commissioners.

Applications for space should be made early to the Secretary, Mr. E. H. Talbott, Grand Pacific Hotel, Chicago, Ill. The other officers of the Commission are: Hon. Lucius Fairchild, ex-Governor of Wisconsin; Vice Presidents: Geo. M. Pullman, President Pullman's Palace Car Co., Chicago, and Aaron French, Pittsburg Car Spring Co., Pittsburg; Treasurers: J. McGregor Adams, Adams & Westlake Mfg. Co., Chicago.

The rest of the Commission comprises: E. V. Cherry, Vice-President Post & Co., Railway Supplies, Cincinnati; A. G. Darwin, President Allen Paper Car Wheel Co., New York; O. W. Potter, President North Chicago Rolling Mill Co., Chicago; H. E. Sargent, late General Manager Northern Pacific R. R., Chicago; James McMillan, President Michigan Car Co., etc., Detroit; Geo. Westinghouse, Jr., President Westinghouse Air Brake Co., etc., Pittsburg; J. H. Bass, proprietor Bass's Car Wheel Works, Fort Wayne; E. H. Williams, Baldwin Locomotive Works, Philadelphia; Wm. S. Eaton, National Tube Works Co., etc., Boston; Wm. Chisholm, President Cleveland Rolling Mill Co., etc., Cleveland; Thomas M. Carnegie, President Edgar Thomson Steel Co., etc., Pittsburg; W. H. Doane, President J. A. Fay & Co., Wood Working Machinery, Cincinnati; M. M. Buck, Railway Supplies, St. Louis; C. W. Rogers, Vice-President Montgomery Stock Car Co., etc., New York; John E. Green, Vice-President Louisville Railway Supply Co., Louisville; H. Clay Evans, Vice-President and General Manager Roane Iron Co., Chattanooga; C. D. Peters, Railway Supplies, London, England. Under such direction, the failure of the enterprise is an impossibility.

PROPOSED PATENT LAWS FOR JAPAN.

Another proof of the capacity of the Japanese to appreciate the conditions of success in the competition of modern nations for place and power, is seen in the favor with which inventions are regarded there. While their nearest neighbors, the Chinese, discourage the introduction of novel devices as undesirable disturbances of the established order of things, the Japanese recognize that they must bring their national industries up to the level of those of the countries of the West, by the introduction of foreign inventions and the development of home ingenuity, or else they must fall out of the race entirely. Accordingly a system of patent laws is proposed, but a serious difficulty is encountered in deciding what their scope should be to secure the greatest advantage to Japan.

It is argued that, because of the backward state of the art in Japan, it will not do to make originality or novelty a condition in granting patents. Multitudes of useful inventions, which from lapse of time have become common property in patent giving countries, are needed in Japan, but they are not likely to be introduced unless some one has an exclusive interest in importing them. Accordingly, it is proposed to grant patents to any person, native or alien, who will introduce any mechanical or other invention calculated to develop Japanese resources. The patentee need not be the inventor, nor is it necessary that the invention be of recent date, provided it be new in Japan, and calculated to be beneficial.

There is a basis of shrewd policy in this, but great care will have to be used in draughting the proposed law, or it will prove the reverse of advantageous to the country. The monopoly granted will have to be limited to the specific device patented and introduced, or else the patentee may gain by the introduction of a single fundamental invention the control of a vast range of later improvements and adaptations, which power may be exercised adversely to the general good in preventing competition and hindering national development in the arts.

Touching the policy of disregarding the inventor, and giving every right to the introducer, it is held that, inasmuch as foreign inventors have never enjoyed any rights under letters patent in Japan, the proposed law cannot be said to take anything from them. It would be a better as well as juster policy, however, to give the inventor a degree of precedence, and allow him a reasonable time to decide whether he wishes to acquire the control of his invention in Japan by means of letters patent. Failure to do this might be taken as evidence of a voluntary surrender of his privilege, whereupon the introducer might set up his claim.

It is further proposed to make provision for the establishment of bureaus of observation in America and Europe, where experienced agents shall be on the watch to discover what inventions and appliances are calculated to meet the needs of Japan, with authority to secure and forward them. If the selected agents are shrewd and capable students of Western arts, and well acquainted with the needs and capacities of their country and countrymen, they may render valuable services for a time, but in a little while individual enterprise may be trusted to do the required work much more effectively.

THE STRUCTURE OF THE CASCADE MOUNTAINS.

The alleged slipping of the basaltic mountain toward the Columbia River, at the point where the river cuts through the Cascade Range, has been attributed to the slope of the underlying sandstone. It is more probable that the slip is upon one or both of the pasty conglomerate beds above and below the sandrock. The structure of the mountain has been studied by Professor J. Le Conte, whose description is quoted as below in the lately published report of Lieutenant Symonds' examination of the Upper Columbia River.

There is found: 1. Along the water's edge, and for about fifteen feet upward, a very coarse conglomerate of rounded porphyritic pebbles and bowlders of all sizes up to five or six feet in diameter, cohering by an imperfectly lithified earthy paste.

2. Above this conglomerate is a very distinct, irregular old ground surface bed, in which are found silicified stumps, with their roots spreading out over twenty feet in diameter, penetrating into the bowlder material beneath, and evidently *in situ*. This is undoubtedly an old forest ground surface.

3. Resting directly in this ground surface, and therefore inclosing the erect stumps, is a layer of stratified sandstone, two or three feet thick, filled with beautiful impressions of leaves of several kinds of forest trees, about whose silicified bases they are found. This layer is not continuous, like the ground surface on which it rests.

4. Above this stratified leaf bearing layer rests a coarse conglomerate similar to that beneath at the water level. Scattered about in the lower part of the upper conglomerate and in the stratified sandstone, and sometimes lying in the dirt bed beneath it, are fragments of trunks and branches of oaks and conifers, in a silicified or lignitized condition. They are evidently silicified driftwood.

5. Above this last conglomerate, and resting upon it, rise the layers of lava, mostly columnar basalt, one above another to the height of more than 3,000 feet.

The history of these formations Professor Le Conte reads as follows:

1. The region of the Columbia River was a forest, probably a valley overgrown by conifers and oaks. The subsoil of this forest was a coarse bowlder drift produced by erosion from older rocks.

2. By excess of water, either by floods or changes of level, the trees were killed, and their leaves shed and buried in the mud, and their trunks rotted to stumps.

3. Tumultuous and rapid deposit of coarse drift containing driftwood covered up the forest ground and the still remaining stumps, one hundred, perhaps several hundred, feet in thickness.

4. The surface thus formed was eroded into hills and dales.

5. Then followed the outburst of lava in successive flows, perhaps for a long period of time, and the silicification of the wood and the cementation of the drift by the percolation of hot alkaline waters containing silica, as happens so commonly in sub-lava drifts.

6. Finally followed the process of erosion by which the present stream channels, whether main or tributary, have been cut to their enormous depth.

The outflow of lava which forms the bulk of the mountain was probably the grandest and most extraordinary lava flow that ever took place. It covered an area of about 200,000 square miles to an average depth of something like 2,000 feet. Its greatest depth was not less than 3,700 feet.

To Mail Subscribers.—A Gratuitous Number.

The day of publication falling one day earlier each calender year has gradually antedated the issue of the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT, so that in regular order the first number of the coming volume would naturally issue on Saturday, December 30.

To avoid the beginning of the new volume before the commencement of the new year, we have decided to give our mail subscribers the benefit of an extra number.

Instead, therefore, of stopping the SCIENTIFIC AMERICAN with issue No. 26, and the SUPPLEMENT with No. 364, which would give the subscriber fifty-two numbers for the year, we shall, at considerable cost, mail to him a fifty-third number. We hope our mail subscribers will recognize our liberality in presenting them with an extra paper, and favor us with a prompt renewal of their subscription. And if any one can influence a friend to join him, who does not know the value of our publications, it will be a good thing for both his friend and the publishers. For terms for the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT for 1883, see prospectus.

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WINTER WORK FOR INVENTORS.

Men of all trades, callings, and professions usually experience during the year what are termed "slack times." A few months of activity are followed by periods when there is not much doing. It is at such times that inventors can make profitable use of their leisure. This has reference especially to that class of mechanics and others who win bread for themselves and families by daily labor, and who cannot afford to devote time to the perfection of new inventions when they can be otherwise profitably employed.

The winter months are the most favorable for the labors of the average inventor; and they who improve the opportunities afforded them by the closing of mills and shops may be reasonably sure of success. During the summer months, when machinery of all kinds is in active operation, is the time to note defects in general design and details of construction to be remedied when the "slack time" comes. During summer the agriculturist discovers faults in his seed planters, mowers and reapers, soil pulverizers, and so on through the entire range of machinery that has been produced for his benefit. Let the inventor now visit him with his note book and pencil, and make sketches and memoranda of what is needed to bring the farmer's machinery nearer perfection. By the next season may be he will be able to make glad the hearts of thousands of farmers by the results of his winter efforts, and while they reap the golden grain with his improved machinery he also will reap a golden harvest.

But it is not agricultural machinery alone that should be overhauled for improvement during the winter months. Let the inventor go forth into the mines, which are usually active in winter, and he will not fail to discover defects in mining machinery that it would pay him well to remedy. Or let him visit some of the lumber camps where thousands of men are employed in cutting and manufacturing lumber, which operation requires a vast amount of machinery. Some of the finest machinery on this continent is employed in the manufacture of lumber in its various stages from the stump to the palace car; but there is yet room for improvements, especially in machinery for more rapid handling during the process from the sled to the loaded car and through the mills to the pile.

It is astonishing what a vast number of operatives in these lumber-cutting establishments are maimed and crippled for life or killed outright by the treacherous saws and flying slabs and edgings. If inventors can provide these saws with shields or guards that would prevent operatives and others falling on the murderous teeth, they will certainly be rewarded. It is not expected that the expenditure of any amount of ingenuity will produce anything that will render these mills absolutely safe; but these horrible accidents can be notably reduced in number, and inventors will do well to labor to that end.

It is not only the novice in mill work that needs protection of the kind in question. The veteran who has long been noted for his skill and care in handling machinery, and who has always been on his guard against accident, may, in an unguarded moment, forget himself and lose a limb or his life or endanger the lives of others. Indeed, the operative of limited experience, knowing his liability to blunder, and having a just appreciation of the dangers of his occupation, usually exercises a greater care than he whose long familiarity with danger has bred a contempt for it. And there is yet another class of unfortunates who need protection by the inventor, to wit: those who visit manufacturing establishments for no particular purpose save to pass an idle hour in wandering aimlessly about among the machinery. The stupidity of these people, who manage to gain an entrance notwithstanding the notice over the doors, "Positively no admittance except to employes," is something remarkable. They have no realizing sense of their danger, and are a constant source of anxiety on the part of the workmen, who may at any moment see their mangled remains scattered about the premises. It is true that in many instances belts and gearing have been boxed for safety; but the weekly list of casualties of this class is a long one, and is conclusive evidence that inventors may profitably turn their attention still further in this direction.

It is in winter that railroad men and others who use iron and steel extensively for tools, machinery, and other purposes are subjected to much trouble and expense by excessive breakages, supposed to be caused by low temperatures, but probably due to something else. The expense to American railways for repairs and renewals of tools and fixtures, rolling stock, and machinery claimed to be due to the effects of severe cold and frost aggregate an immense sum per annum. Track men complain of failures of cold chisels, punches, hammers, mauls, crow-bars, claw-bars, wrenches, etc., and broken frogs and switch fixtures are frequently met with in cold weather. Rails, wheels and axles, and the iron or steel members of bridges and roofs are said to fail at extreme low temperatures; and distressing railway slaughters have been due, it is alleged, to the effect of frost on iron and steel, but this, we suspect, is rarely the real cause of the trouble. Jack Frost is too often charged with crimes that belong elsewhere. A wide and inviting field of labor is open to the inventor in studying out true causes of evils such as we have indicated and in devising the proper means for prevention.

Many lives and much property are destroyed by the cause under consideration. It is difficult to conceive of a wider and more inviting field of labor for the inventor than to search for some new process of manufacture of iron and steel that would render these metals more capable of withstanding the weakening effect of severe cold. At first thought this may seem a doubtful undertaking; but when it is remembered that articles of iron and steel resist the action of frost according to the quality of the material and the processes employed in their manufacture, the mountain becomes a small hill that may in all probability be removed by methods well known to American inventors. Of course, elaborate experiments will be required; and the coldest weather is the time for experimental and practical tests of this nature or for the purpose indicated. Winter is also a favorable time to "prospect" for faulty car heaters and ventilators, and inventors who have labored in this direction will do well to improve the winter by giving practical tests of their devices.

WM. S. HUNTINGTON.

Yazoo Bridge.

For several weeks past we have made frequent mention of the progress of construction of the piers for the great iron bridge now building over the Yazoo River at Anthony's Ferry, twelve miles above this city, for the Memphis, Vicksburg, and New Orleans, or what is better known as the Wilson line of railroads. The cost of the entire structure will be between $225,000 and $250,000, and when completed will be second to none in the South. The contractors have now about 150 experienced men at the work, which is progressing as rapidly as possible. Captain John A. Grant is chief engineer, R. H. Elliott, chief assistant engineer, and Colonel C. J. Graves resident engineer.

The construction of a bridge at the point of crossing of the new road is for several reasons unusually difficult and expensive. There is no bed rock or other impregnable material within reach for the foundations to rest upon. The river at low water, even, is nearly 40 feet deep, while at high water it is 80 to 90 feet. During the summer and early autumn the unhealthiness of the region would entirely unfit men for the trying labor required of them, so that the period during which the work has to be performed is limited to three or four months, and hedged in between fever and floods, the utmost energy must be exerted to accomplish the work.

The bridge will consist of three spans about 300 feet long each; two of them "fixed" spans, and the third a "draw span," located in the middle of the channel. These will be some six feet above the level of extreme high water and slightly above the elevation of the banks on either side. There will be five piers, one at each end on the bank and three in the river. To obtain the requisite supporting capacity, piles—100 in the pivot, and 72 in each of the other two channel piers—are driven to a depth of 40 feet into the river bottom. The outfit to drive these piles consists of a regular pile driver engine, with a 4,000-pound hammer, a Skinner steam hammer, weighing 7,000 pounds, and a large duplex Worthington pump to supply a water jet, when this can be used in place of driving, or to assist the latter. When the jet can be used to advantage, pipes are so arranged that one or more powerful jets, such as fire engines would supply, is brought into play at the point of the pile, excavating a hole for this latter to sink into. The Skinner steam hammer is simply a steam hammer similar to those seen in large machine works, which is held over the pile in such a manner that it may pound the pile down by hitting it successive blows with great rapidity. The piles for one pier have now all been driven and have reached such a firm bearing that an excellent foundation for the piers is assured. One visiting the bridge site now would see the left bank occupied by a number of buildings, the apartments and boarding house of the men engaged on the work, storehouse, offices, etc., which have sprung up in a few days, and huge piles of sand, stone, and cement in readiness for use. In the river is a floating saw mill preparing timber to be used in the caissons. In the river is one of the latter just launched, and on the bank is another almost completed. These are nothing more nor less than huge wooden diving bells. The one for the first pier is 50 feet in diameter with sides two feet thick and six feet high. Its roof will be seven feet thick of solid timber. A "pneumatic caisson" may be described as an immense box with no bottom, but otherwise air-tight. After the piles are driven, they are sawed off under the water surface. A caisson is then floated over the piles. The construction of the pier proper, which will consist entirely of concrete, is then commenced on the roof of the caisson while this is still afloat. As it sinks it is held in the proper position, and when it touches the piles, air will be blown into the caisson by means of large air compressors run by steam. Men descend into the caisson through a shaft provided for the purpose. This shaft has two air-tight doors in it, one at the top, above water, and one at the bottom, which is in the caisson roof. When the men enter, the lower door is closed. After entering the shaft, the upper door is closed and a small valve from the air chamber of the caisson is opened into the shaft where the men are, allowing the compressed air from below to enter gradually. When the pressure in the shaft becomes equal to that in the caisson below, the lower door is opened and the men descend into the caisson provided with saws. They saw off the piles as low as can be, that is, even with the bottom of the caisson, and the caisson is then sunk still lower. This sawing off and sinking is continued until the caisson is settled even with the bottom of the river. While this sinking has been going on, the concrete has been built upward, and when the caisson is settled firmly on the piles for the last time, the pier is built up to the proper height to receive the coping, which will be of stone two feet thick. On this the iron bridge spans will rest. These piers when complete will consist of piles sawed off level with the bottom of the river. Surmounting these is a solid platform (the roof of the caisson) of timber seven feet thick on which will rest the piers proper, which will be one continuous mass of concrete, a tremendous monolith. Some idea of the enormous quantity of material in the piers may be formed from the quantity of cement to be used, which will be in the neighborhood of 10,000 barrels. The piers are being built by Wm. Sooy Smith & Son, of Chicago, who have been either engineers or contractors for several of the largest works in the country. The design is thought to be peculiarly well adapted to the character of the crossing, and surmounted, as the piers will be, by a correspondingly excellent superstructure, the Yazoo River bridge will be a prominent feature of the great new road.—*Vicksburg Commercial.*

A Medical Opinion of the Electric Light.

Before the electric light becomes, as it must soon become, the common illuminating agent of the period, says the *Lancet*, a determined effort should be made to devise some mode of mitigating its peculiarly unpleasant intensity. The vibratile impulse of the electric force is obviously stronger than the delicate terminal elements of the optic nerve in the retina can bear without injury. We are wont to apply the adjectives "hard" and "soft" to light, and their significance makes them peculiarly appropriate. The electric light is too hard; it needs to be softened. The waves of motion are too short, and the outstroke—so to say—joins the instroke at too acute an angle. This might doubtless be obviated by employing suitable material for globes and shades, but perhaps the best plan would be to break up and scatter the rays of light by reflection. If a small convex reflector were placed immediately below the light in the protecting globe, and one of larger dimensions above it, so as to secure a double reflection with ultimate divergence downward and outward, the effect would be to cause the "rays" of light to fall obliquely on all objects within the immediate area of illumination. This would, perhaps, obviate the need of colored glasses, which the promoters of the electric light seem to dislike. Certainly there is a considerable sacrifice of power in the use of the opaline globe—so much, indeed, that some of the districts lighted by electricity displayed through this medium do not present any obvious superiority over gas. We throw out the suggestion for what it is worth. Something must be done, for, as it is, the electric light is "trying to the eyes," which means that it is in danger of injuring them, and already, there is reason to believe, mischief has been wrought by its use. For true comfort there is nothing like the light given by the old-fashioned pure wax candle.—*The Electrician.*

THE STEAM STREET SUPPLY IN NEW YORK.

There still seems to be trouble in keeping the joints tight under our streets. The screw joints do not seem to hold their own, either from inadequate material to give strength to the fittings, unusual strain by expansion, or unskilled labor in screwing the threads home, as fresh outbreaks are of almost daily occurrence.

Screw fittings should be made unusually strong and suited in every particular to the magnitude of the work, for there is no economy, and at most a mere make-shift, in the resort to the use of clamps and putty. The cause that disturbs or ruptures the joint at first will soon affect the clamps.

In our comments upon the progress of the steam supply in our issue of December 9, we aimed to criticise the want of care and time in making up the rubber combination joints. We were far from intending to find fault with the rubber combination itself as a packing (the Jenkins), which is now so extensively used for steam and other purposes, and has the highest reputation for excellence. We have in mind an example where this packing is now in use with steam under a pressure of from 150 to 225 pounds to the square inch, and was tested to near 300 pounds.

The first screwing up of bolts upon the flanged joints was not final, but gradual, as the heat and pressure was increased, until a solid vulcanite was obtained between the faces of the flanges.

One More Number.

The next issue will close another volume of this paper, and with it several thousand subscriptions will expire.

It being an inflexible rule of the publishers to stop sending their publications when the time is up for which subscriptions are prepaid, present subscribers to the SCIENTIFIC AMERICAN or SCIENTIFIC AMERICAN SUPPLEMENT will oblige us by remitting for a renewal without delay.

By heeding this request to renew immediately, it will save the removal of several thousands of names from our subscription books, and insure a continuance of the papers without interruption.

THE management of the Standard Theater (New York) announce that on Saturday the electric lights with the Faure accumulators will be carried for the first time by the ballet girls in "Iolanthe." Experiments have been going on for some time with the aid of the best practical electricians in the city, and the result has been most successful. This use of electricity has been very successful in London, and its introduction here will add further possibilities in the way of effective ballet grouping.

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ANCIENT COUNTERPARTS TO MODERN INVENTIONS.

The statement that Henry VIII. possessed a breech-loader on the Snider system (Mark II.) and also a muzzle-loading rifle; that the Spanish Armada carried wrought iron breech-loading guns fixed on pivots, with all recoil checked, like Krupp's pivot guns; and that Marshal Vauban had a breech-loading small-arm whose breech closed with an interrupted screw, would probably be treated as statements containing some double meaning or altogether made in joke. Nevertheless, we propose to show how very nearly these are sober facts The pieces themselves, with innumerable other curiosities in artillery are open to public inspection in the Rotunda Museum on Woolwich Common. The pieces are well arranged and catalogued, thanks chiefly to Sir H. Lefroy, K.C.B. We propose from them to give some illustrations of modern ideas forestalled in ancient times; but before doing so we would strongly protest against the use to which such anticipations are apt to be put. We hold that if a successful invention has established its reputation, it is a most unjustifiable thing to dig out of some obscure corner in a museum something that in a measure has the same idea embodied in it, and treat the unfortunate inventor as a sort of pirate by confronting him with a design that he never had seen or heard of—of which the worth was perhaps never suspected until worked out to a successful issue by the modern inventor. While, however, in no way detracting from the credit of inventors of our time, we cannot fail to see that in very many instances designs subsequently successful have been fairly worked out hundreds of years ago and allowed to drop into disuse. How is this to be accounted for?

We think it is due to the deficiency of machinery and of means of reproduction. A design might be worked out formerly by a skillful mechanic which, although rough to modern eyes, answered fairly well; but the idea of manufacturing the same article by the thousand seemed wild unless the pattern was very simple. With ordnance also we think that the difficulty was aggravated by the comparative ease with which powder was improved. The half developed breech-loaders with bad, rough joints, for example, would manifest such faults that simple sound muzzle-loaders would be far preferable. The rough wrought iron guns made of hoops and staves would in the same way give place to those of cast metal. Then the real powers of rapidity of a Snider or a Colt's revolver action might be masked by the imperfection of the old fashioned lock used in connection with them. It is easy to see how designs might remain in the stage of ingenious curiosities, until they ceased to attract attention, two hundred years ago—designs which would in the present day quickly assert their superiority, because they would be well and easily manufactured. Apparently our ancestors had as much ingenuity as ourselves, though circumstances were unfavorable to their success. It is interesting then to trace out the representatives of many of our best modern designs, while we, at the same time, distinctly repudiate the idea that the existence of the old ones detracts from the claims of the new, unless it can be shown that they were actually copied from them. This, we hold, with perhaps rare exceptions, is out of the question; and even were it not so, considerable credit still attaches to the man who can seize what is good in a collection of obsolete arms. To come, then, to actual designs. We will first take the question of metal and its structural arrangement. Fig. 1 exhibits a remarkable group of guns. They are classed together in the Rotunda Museum, but by the permission of Major Hime, R.A., the secretary of the Royal Artillery Institution, they were grouped specially in order to make the photograph shown in our cut.

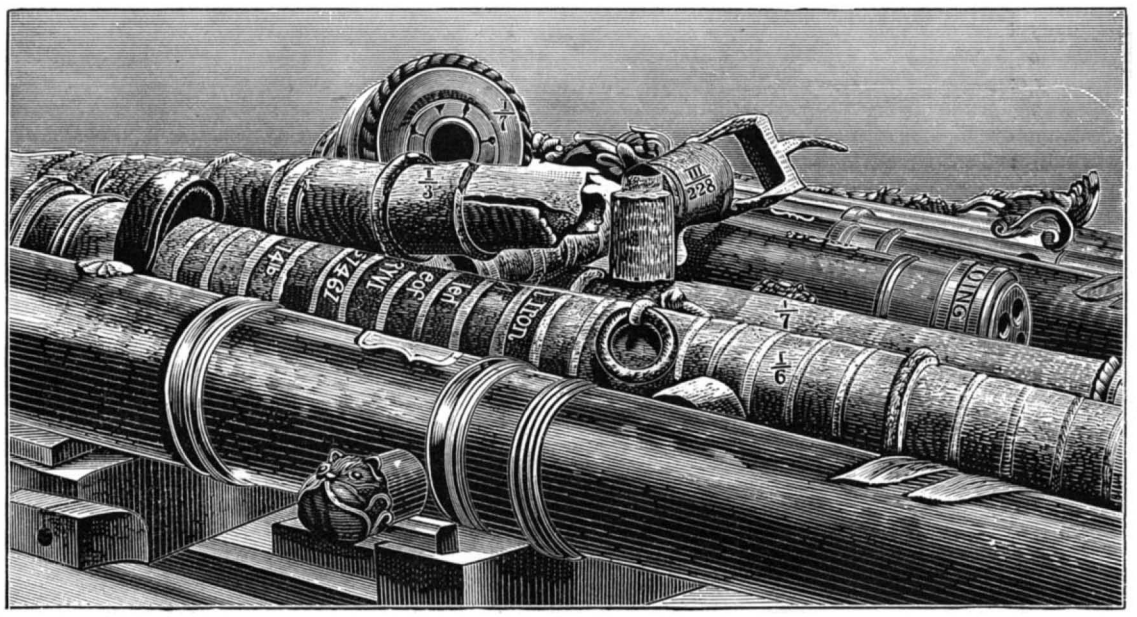

Fig. 1.—GROUP OF ANCIENT BUILT UP WROUGHT IRON GUNS.

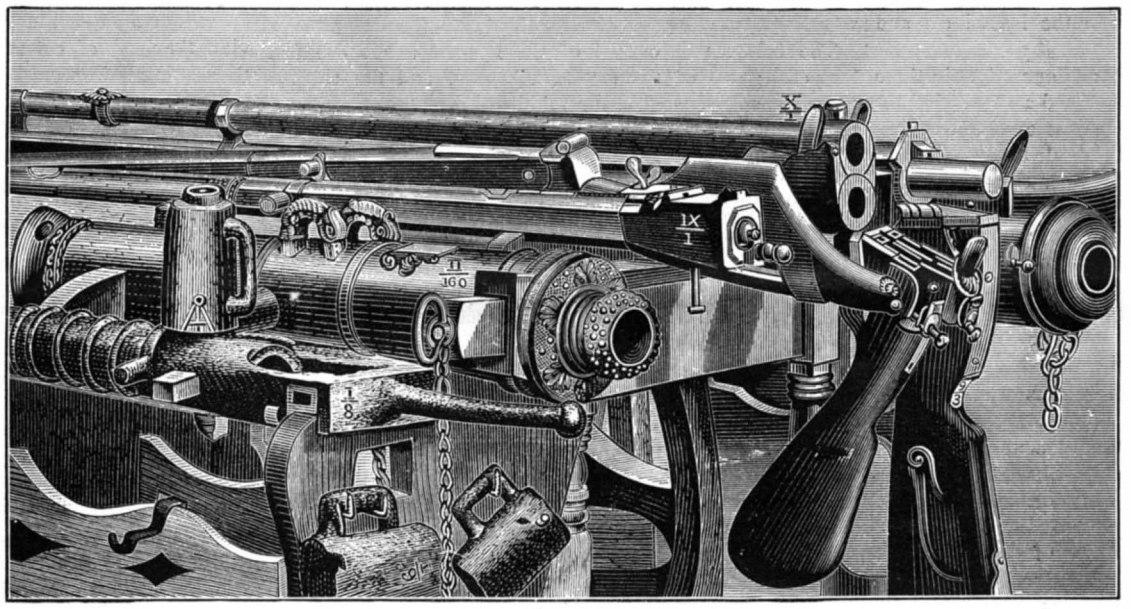

Fig. 2.—GROUP OF ANCIENT BREECH-LOADING GUNS.

The guns marked I/3, I/6, and I/7 (these being their actual Museum numbers) are some of the oldest to be found in England, belonging to the first stage of the existence of artillery.

I/1 is a portion of a wrought iron cannon thought to belong to the fourteenth or fifteenth century, found with others in the sands of Walney, Morecombe Bay, by Mr. C. A. Archibald, and presented by him to the Museum. It may be seen that this piece is built up of longitudinal pieces of wrought iron running along the bore, like the staves of a barrel, held together by hoops or rings of wrought iron. Strength in the tangential and longitudinal directions was in this case separately supplied by the exterior and interior portions of the gun respectively. The serpent cannons, Nos. I/6 and I/7, are of nearly similar construction.

No. I/7 having been injured, it was judged right to cut it open to exhibit its structure. The breech of it is seen in cross section over the other guns. The interior ring is gun metal at this portion of the piece, the chamber being lined with a cylinder of this material. Outside this are longitudinal flat bars, placed like staves of a barrel, but two deep, welded together imperfectly, leaving interstices which are sealed up with lead. Outside are thirty-five rings or hoops, averaging 2·3 inches in width and 1·5 inches thick near the breech. These have been burred down while hot at their edges, and the joint closed. The iron is of excellent quality, giving a tenacity of about 55,258 pounds to the inch, nearly resembling that now employed in wrought iron guns—*vide* R.A.I. catalogues.

How far are modern principles embodied in these primitive designs? We cannot admit that there was great merit in the employment of wrought iron, because in early times it might only mean that the art of casting iron was imperfectly mastered. We cannot, for example, argue that wrought iron was preferred to cast metal because the latter cannot be adjusted to meet the strains that are now known to fall on the successive layers of a gun. All we can distinctly say is that the iron was placed so as to adjust its fiber to meet longitudinal and tangential strain, and that bronze had been employed to bear the erosion of the powder gas at the seat of the charge, where it unquestionably was better suited to the work than wrought iron with imperfectly closed joints. There is, however, altogether a considerable measure of science applied to very rough manufacture. The wrought iron breech loader, No. III/228, is remarkable. It came out of the Spanish Armada. It has the curious tail piece running from the breech common to such guns. The chamber may be seen placed on end in front of the piece, standing on I/7. These chambers were entered into the opening, which was presented upward when the gun was mounted, the gun, in fact, being slotted through vertically; the chamber was then secured, generally by a pin. It may be seen that the charge must have been very weak to suit such a gun. In many cases these guns were mounted on pivots, where there was no more allowance for recoil than in Krupp pivot boat guns. Here, at all events, we have the advantage of

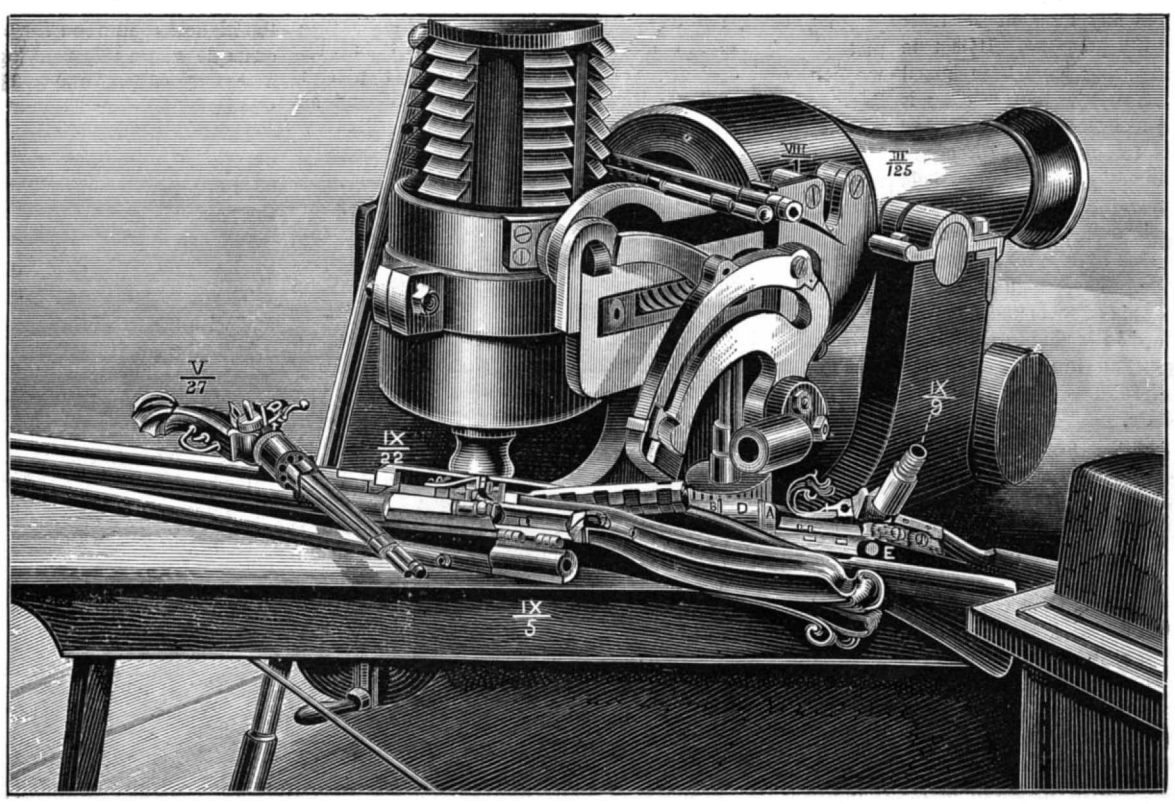

Fig. 4.—GROUP OF ANCIENT ARMS.

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loading at the breech connected with absence of recoil, in a way that no roughness of manufacture can conceal. The principle of non-recoil was frequently, of course, embodied in wall pieces on tripod stands. We did not learn breech-loading from the Spanish Armada, for in Fig. 2 will be seen a similar gun, I/8, which looks better made; but it apparently has not been subjected to the same influences of weather—indeed, the Armada gun looks as if it had laid under water for a long time, which reminds us, by the way, that there is a breech-loader taken up out of the wreck of the Mary Rose, sunk in 1545, on which the action of sea water for three hundred years has indeed played havoc. This gun, in Fig. 2, No. 8/—, is of the time of Edward IV.—A.D. 1461 to 1483. It is made of longitudinal bars of iron hooped with iron rings. The chamber with lifting handle is complete. The vent is well preserved. Length of gun, 3 feet; caliber, 2·5 in.; weight, 1 cwt. 13 pounds.* The breech end in this gun fits on over the barrel below the trunnions. The curious square-shaped projection behind the trunnions appears to be a sort of rough key piece holding the two parts of the gun together. The bolt hole for securing the chamber may be seen in the side. Other chambers with handles may be seen in this cut. If we learned nothing in breech-loading from the Spanish Armada, we might apparently at a subsequent date have taken something from the Dutch, judging from No. II/160, Fig. 2, which is dated 1650. It is a brass breech-loader, a very handsome gun. The bore is continued through the cascable, being closed at the breech after loading by a wedge (*vide* cut) moving horizontally, being on the same general idea as that of Krupp. This gun was found by Captain—now Admiral—Selwyn, R. N., in a deserted Dutch fort near the mouth of Gambia River about 1851. The actual wrought iron wedge is modern. The gun IX/1, Fig. 2, is another remarkable one—also classed I/21; it is of wrought iron, beautifully finished, and bears the date of 1619. It is inlaid with gold and silver, and bears the cipher of Louis XIII., with initials M. and R., etc. The bore is continued from end to end. It has a vertical slot and a vent piece, in which is a vent with the first portion vertical and last portion horizontal, like that of the first Armstrong system. Fig. 3 shows the breech open. It will be seen that the breech piece is worked from a lever below, reminding one somewhat of the Martini lever, though it has not much in common with it, having comparatively an awkward motion. The lever, B, brought down the block, A, to open the breech. In closing the cap, C, had a catch, which holds into the breech end of the entire gun. The hinge, D, is broken; there may have been some special piece there suited to the descent of A in a straight line.

The French wall piece X/1, Fig. 2, is an ingenious double barreled one, loading at the breech. The date is about 1690. The barrels are rifled, being grooved with twelve rectangular grooves. Caliber, 1·45 inches; length of rifled portions of the barrels, 7 feet 8·8 inches; length of unrifled portion—for the charge cylinders, 9·25 inches; total length of piece, 8 feet 8 inches. The breech bolt carries the motto of Louis XIV. The year 1690 is an early date for a rifle; but there is an earlier specimen, namely, a barrel taken from Hungarian insurgents in 1848, with a date of manufacture on it of 1547.

The grooving is not visible at the muzzle, having been obliterated; but on removing the breech plug, six fine grooves, with a twist of 1 in 26, were discovered. It is thought improbable that a specimen of rifle of an earlier date than this can be found in any collection, Danner, of Nuremberg, having been commonly said to have perfected the rifle about 1552 A.D.

Our object, however, is to select the special features that have come in in modern times as new, and we would call attention to the group depicted in Fig. 4. The musket—IX/9—is a breech-loader. The invention is ascribed to Marshal Vauban. Mr. Hewitt has shown from an English example in the Tower that this combination of flint lock and breech-loading was known in England in the time of James II. The feature we wish to point out is the interrupted screw, which forms so characteristic a point in the new French breech-loading guns and those adopted in our service during the last three years. The interrupted screw was on the front end of the breech block turned up. The corresponding interrupted thread was in the enlarged breech end of the barrel, A.

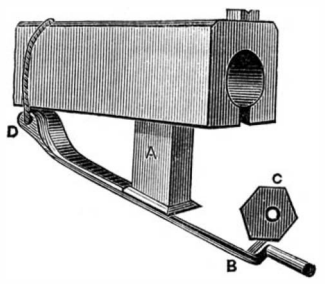

Fig. 3

The barrel, B, with a portion of the stock, C, attached, was free to slip forward and backward through the collar, D, attached to the main portion of the stock, E.

To close the breech, the breech block is turned down, the barrel slid home on it, when turned round in the proper position for the interrupted threads to pass through the openings cut away. Then the barrel was turned so far round that the threads engaged and locked, the wood parts of the stock in that position coming fairly together.

This, then, was a very good, business-like breech action, in our opinion far better than many that competed about 1866. That date, however, naturally suggests to us the well-known Snider system of conversion. Now, we will ask our readers who are familiar with the Snider to look at IX/5, attributed to the time of Henry VIII., when we think they cannot fail to be struck with the identity in general idea of this breech-loader with the Snider.

The Snider offered the advantage of adaptation of hammer and lock to firing a central-fire cartridge, and of application of shoe containing breech block to barrel by tapping and screwing without any operation involving the heating of the barrel. These, as well as the sliding extractor, do not belong to this piece. Nevertheless, the resemblance of the general idea is remarkable.

VIII.

Small-arm No. 1/—, whose barrel is seen in cut, C, is comparatively a modern piece, having been proposed by Sergeant-Major Moore, R. A., in 1839. The arm is dated 1843. It is remarkable as having the hexagonal system of rifling recommended subsequently by Sir J. Whitworth. The twist is almost identical, being one turn in 29·5 inches, the caliber being 0·71 inch. This amounts to a spiral of one turn in forty-one calibers. The Whitworth rifle pattern, 1862, had a twist of one in 20 inches, with a diameter across angles of 0·49 inch, which amounts to a spiral of one turn in nearly 41 calibers. The combination of hexagonal rifling and spiral is, then, almost identical with that afterward proposed by Whitworth; but we have no sort of reason to question the originality of the latter.

V

If these two last are striking, what will be said of 27/—, which is a six-chambered revolver pistol of the 17th century, with wheel lock? A casual observer might almost pass it as a Colt's revolver; diameter of bore, 0·35 inch; length of barrel, 14 inches. Among the small arms there are found examples of rifled arms, breech-loaders, and a six-chambered revolver. Can we complete the series by anything like the piece that is now finding its way into the equipments of nations—that is, a magazine arm? Such an arm is found in IX/22, which is seen in Fig. 4. It is a crude affair, the charges being inserted in succession in the magazine, B, probably with tight wads between them. Each charge occupies a given space with its own touch hole. The flint lock is made to slide along a guide bar. It is worked by a trigger in the stock; it is moved forward to fire the front charge, and drawn along to stops in positions fixed to enable it to fire the other charges, probably in rapid succession if everything went right, but this we should think seldom

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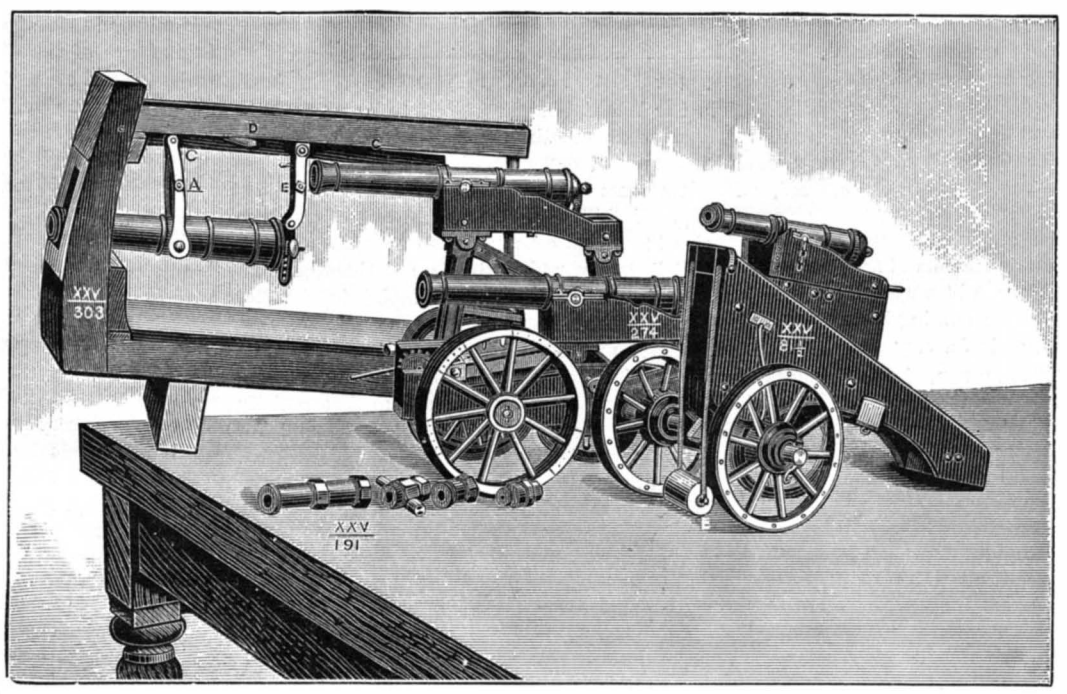
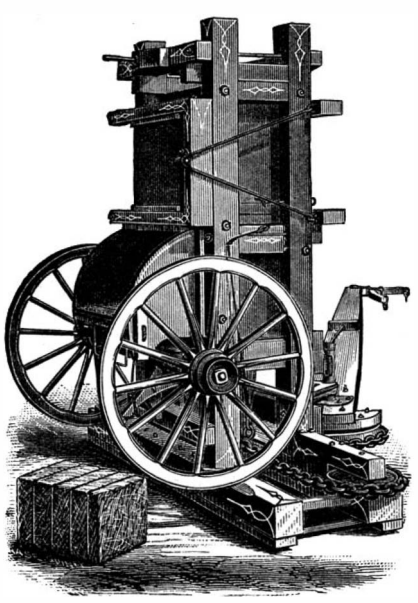
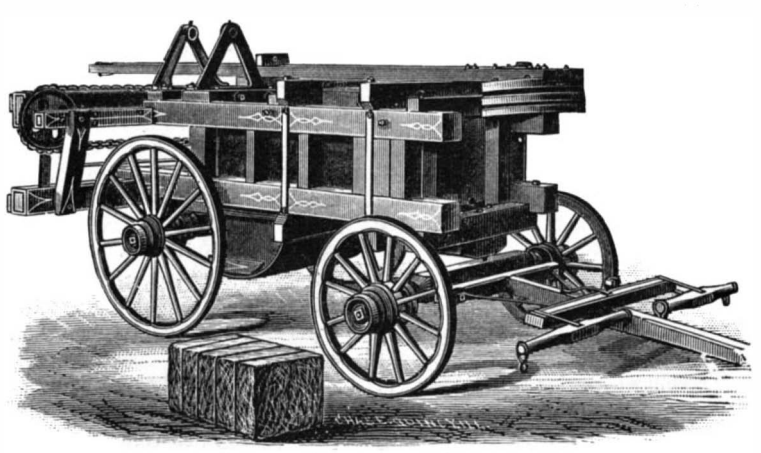


Fig. 5.—GROUP OF DESIGNS FOR CHECKING AND STORING UP FORCE OF RECOIL.





ERTEL'S PORTABLE HAY AND MOSS PRESS.

PORTABLE HAY AND MOSS PRESS.

The engraving represents a new portable hay and moss press manufactured by the patentee, Mr. George Ertel, of Quincy, Ill. This press is of entirely new design, and is much lighter than other presses for the same purpose. It is small, compact, and works easily, turning out from five to seven tons of hay per day, one horse doing the work.

Being a double acting machine, it operates very rapidly. It presses the hay upward in separate charges, insuring freedom from dirt and gravel. The hay in the bale lies lengthwise and is bound up crosswise.

The average weight of bales turned out by this machine is 100 pounds, a convenient size easily handled. This press is mounted on four wheels, and arriving at the hay the sweep is taken down from the press, the nut on the king bolt taken off, and then the press is set up, swinging on the hind wheels, and as soon as sweep is placed it is ready for work. Two men and one boy, with one horse, can operate the press successfully.

The press is operated by an ingenious arrangement of toggle links acted on by a chain connected with a drum moved by the sweep to which the horse is hitched. The machine works both ways, so that whenever it moves it is doing its work. We understand that a number of these presses have been sold, all of them giving excellent satisfaction.

*"Mons Meg" in Edinburgh Castle belongs to this period. It is said to have been made in Mons, in Flanders, in the beginning of the fifteenth century. It was employed in the siege of Dumbarton Castle in 1489, and last fired in 1682, when it was injured.

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ANCIENT COUNTERPARTS TO MODERN INVENTIONS.

(*Continued from page* 403.)

happened. Other magazines were provided to replace the first when exhausted. In this arm, then, crude as it is, we have the idea of a magazine fairly carried out, though struggling with difficulties in mechanism.

Leaving arms, we will pass on to the question of mounting and working guns. Can we find an ancient inventor corresponding to Moncrieff? or can we find the hydraulic buffers, muzzle pivoting, or overbank arrangements that have latterly come into the service? or, again, guns carried in pieces and united by screwing together in lengths? Now we confess we can find no sign of hydraulics being known, but we can find the remaining ideas fairly represented. In Fig. 5 will be seen a design of Sir William Congreve's, $\frac{\text{XXV}}{303}$. The object is to deaden recoil and facilitate working. The gun is suspended on a system of jointed bars, A and B, attaching it to a directing bar, C C, which is pivoted nearly over the muzzle of the gun, traversing along the curved arc, whose end is seen at D. This offered the advantages of deadening recoil, of good direction, the gun coming back to the position in which it was last fired, and of a very narrow port. We admit that we wonder Sir William, having got so far, did not make his gun a breech-loader. It is to be observed that the weight of the gun would oppose a gradually increasing resistance to the recoil, on much the same principles as that of the Moncrieff counterweight. So ingenious is this design that we think it is quite open to question whether as a breech-loader it might not be made to succeed at the present day. The gun is not here brought under cover, nor is the work of recoil stored up; but these elements are found in $\frac{\text{XXV}}{81\frac{1}{2}}$, Fig. 5. Here a gun is made to descend a steep incline by recoil, in its descent lifting a counterweight, E, suspended in front of the carriage by ropes running over pulleys, which, if sufficiently heavy, would run up the gun when required into the firing position. It was intended evidently for siege train work, the lower carriage being a traveling one, and having wheels, of which the hinder pair are removed in the figure.

No. $\frac{\text{XXV}}{274}$ is a design for a pair of overbank carriages, the guns traveling on low carriages, but being raised by a jointed frame of bars to fire over a high parapet when required, and lower under cover after ceasing firing. No. $\frac{\text{XXV}}{191}$ is a gun made to be unscrewed into six pieces. We cannot furnish the date of the design. Probably it is older than any one's memory would take them, but not so old as the guns made to unscrew by the Turks in the middle ages.

We will not tire our readers by describing other things good and bad, such as a naval piece discharging seven barrels simultaneously, which is a very poor attempt at a machine gun, if it is one at all; a leather and copper gun, wound round with hempen cord, said to have belonged to Gustavus Adolphus; and "infernal machines" so called, which are awkward forms of machine guns. These things are generally better understood by actual inspection of the arms than by any description. The Rotunda Museum is a Government one, thrown open to the public free of charge. It is visited as a popular museum by many, but if Woolwich were not out of the way, it might be better known to scientific visitors. It certainly contains very interesting designs in war material. In the case of models, of course, we should bear in mind that we have before us only a model, and not necessarily a design that would answer its purpose when worked out, but this does not apply to the case of the arms themselves. We think that it is easy to satisfy ourselves in such a collection that men were as ingenious in designing destructive implements some centuries ago as at the present time. Progress, however, was, as we have said, mainly hampered by the imperfect development of machinery and difficulty of reproduction.—*The Engineer.*

Chemical Tests for Portland Cement.

With reference to tests for Portland cement, it is recommended that, in addition to the usual trials of strength, weight, and fineness, a chemical test for common adulterations should be made. In order to discern whether cement has been adulterated with blast furnace slag, 5 grammes of the suspected material are put into a glass vessel containing 50 grammes of dilute muriatic acid containing 1 part of pure acid to 4 parts of water. The mixture should be well stirred with a glass rod. Pure cement is not rendered turbid by this treatment, but imparts a yellowish color to the solution. If, on the contrary, the liquid turns milky, from the presence of sulphur in suspension, while at the same time the yellowish tinge disappears and a strong smell of sulphureted hydrogen becomes perceptible, this is an indication that cinders have been added. The presence of ground limestone or chalk may be detected in a similar manner by the occurrence of ebullition at the time when the liquid acid is added to the cement. The quantity of added material may be approximately found by the degree of ebullition. Pure Portland cement does not effervesce upon the addition of acid, because it does not contain carbonate of lime, but is chiefly composed of lime, silicia, alumina, oxide of iron, magnesia, sulphuric acid, and water. The proportions of these ingredients vary in samples from different localities; but lime is always about 60 per cent of the whole, the remainder occurring in the order stated above. Sulphate of lime should not exceed 1 per cent; but the greatest value is attached, especially in Germany, to the presence of magnesia. English or French cements seldom contain 1 per cent of this substance; but the proportion rises to 3 per cent in some German cements. Perhaps the most essential points to be regarded in the manufacture of cement, apart from the question of chemical composition, are uniformity of mixing and burning and fine grinding, without which the material is valueless.

Straight Tread Car Wheels.

The Griffin Car Wheel Company, of Detroit, Mich., have been for the past three months turning out 150 wheels per day, of all kinds and diameters, with straight or coneless tread, on orders from railway companies, so that their economy and practicability is in a fair way to be tested. All the wheels of these patterns are cast so as to measure when cast the full size by which they are designated; that is, a 33-inch wheel measures exactly 33 inches in diameter on the tread line. It is a fact not generally known, that most 33-inch wheels are so only in name, ranging from 32 inches upward in diameter; other sizes in the same proportion. All of these new pattern wheels are made especially heavy with a view to meeting the increased demand for strength consequent on the heavy loading of freight cars. The outside inch of the edge of the tread is beveled or coned off one-eighth inch in the chill, so as to prevent the chipping off of the tread when passing over frogs, etc. This has been partially done heretofore on some makers' wheels in rounding off the corner of the tread, also in casting the outer edge of the tread in sand. The latter idea, however, is objectionable from the fact that the sand is liable to allow lumps and swells to form in the very place where it is most necessary to avoid them. In the coneless wheels referred to, the chill in which the wheels are cast is turned out so as to produce the bevel on the outer edge of the tread, in the chill, thus presenting a smooth, even finish, and absolutely preventing anything in the shape of a swelling or lump on the tread. The total output of the Griffin Car Wheel Company, and the Griffin & Wells Foundry Company, of Chicago, is 450 wheels daily, the greater part of which is being disposed of to railway companies for their monthly requirements. They are increasing this output, as it is not sufficient to keep pace with their orders.

How Some Old Walls in Rome Were Made.

On the west side of the Piazza Vittorio Emmanuele, where large houses are being built by Signor Marotti & Co., a peculiar wall has been found. It gave us some two hundred pieces of marble bodies. As far as I can judge, they belong to four statues, but a great many fragments have not yet been classified. One of the statues, of colossal size, seems to represent an athlete of the Greek-Roman school brought to such perfection under Hadrian. Another represents a female figure, perhaps a Faustina. There are, besides, lovely busts of Hadrian, of Antinous, and others. It is difficult to state at what period these works of art were turned into building materials. Perhaps they met their fate in the Middle Ages, although I should not wonder if such things had happened before the fall of the Empire. Here is an example of statues walled up under Aurelian: A new gate is being bored through the walls of the city to afford a direct communication between the Esquiline and Saint Lorenzo fuori le Muri. Between the third and the fourth tower south of the old gate, the walls, ten feet thick, are patched up in the following way: the outside face is of brickwork of the time of Aurelian; the inside face belongs to an earlier building, of which Aurelian took advantage, as it fell exactly on the line of his projected ramparts. It is an inclosure or foundation-wall of a garden, handsomely ornamented with a rustic kind of mosaic made of shells, colored stones, and pieces of enamel, such as are often seen in Roman nymphæa and fountains. The wall had rows of nitches for statues. Three niches have been found in cutting the new gate, and in front of each one the corresponding statue lay imbedded in the nucleus of the wall. One represents a sitting Venus, of no artistic value; the second and the third represent fighting fauns, bright and spirited in their attitude, well chiseled, and beautifully preserved.—*The Athenæum.*

Typhoid Fever and Malarial Waves and Their Relation.

In a recent monthly report, the Secretary of the State Board of Health of Connecticut gives statistics showing an increase in typhoid fever, and comments upon its relation to malaria as follows:

"This return of typhoid fever to prominence, and its steady increase in frequency for the last three years, is apparently a part of an extensive and comprehensive movement. As the epidemic of malaria was ushered in by a decrease, and in places almost, if not quite, a total disappearance of typhoid, this return of typhoid fever to its former importance and relative frequency is an intimation of the decrease and disappearance of malaria. The tendency toward typhoid fever commenced several years ago, and has steadily grown stronger each year, as shown by the increased prevalence, tendency to unusual frequency and severity, and the increase each year of deaths from this cause. As the decrease in the frequency of typhoid preceded the malarial wave, so its increase precedes the entire disappearance of malaria, or at least gives us some ground for hope that such a disappearance will take place. This disappearance of epidemics of malarial fever on a large scale has often been followed by an unusual prevalence of typhoid fever or an extensive epidemic. The epidemics of malarial fever of 1807 and 1824, which are stated to have extended over all Europe, were followed by typhoid fever." The writer thinks that the spread of malarial fevers over Connecticut, Massachusetts, and Rhode Island has ceased.

Tests for Lubricating Oils.

It is stated that a good test for lubricating oils is to place single drops of the different kinds to be compared in line across the end of a piece of plate glass about twenty-four inches long, one end being six or eight inches higher than the other, to form an inclined plane. The drops of oil run down this smooth plane in a race with each other. The quality of the oils for lubricating purposes is shown by the distances traveled and the trace left by the drops. Thus, on the first day sperm oil will be found in the rear; but it will in time overtake the rest, and retain its power of motion after most other oils have dried up. A light-bodied oil flows quickly, like water, but also dries quickly, whereas what is needed is a good body combined with a limpid flow. Many oils have a good body, but have a tendency to gum; and this will be distinctly shown upon the glass. It is scarcely necessary to remark that the test slip should be covered from dust while the experiment is being made. The above method will show the physical qualities of different descriptions of oil; but if the presence of acid is to be detected, another simple device may be adopted. In a sheet of bright copper a number of shallow pits are made by the blow of a round-faced hammer. Samples of oil left some days in these dishes on a shelf in the engine-room will show, by the formation of verdigris, where acid is present. The existence of a blue tinge of fluorescence in a glass phial of oil is frequently assumed to indicate the presence of mineral oil; but this is an illusory test, since the same effect is frequently observed in the purest and freshest vegetable oils.

Pure Carbon for the Electric Light.

The manufacture of carbons free from ash can be accomplished, according to Jacquelain in *Comptes Rendus* (xciv. 837), by passing dry chlorine gas over pulverized coal or coke heated to bright redness. All of the silica, alumina, and magnesia, as well as alkalies and metallic oxides, would be converted into volatile chlorides and expelled; even the hydrogen is driven off as hydrochloric acid.

The easiest method of carrying out the process on a large scale is to allow the dry chlorine gas to act upon gas carbon (from the retorts) cut into thin prisms for thirty hours, and then raise the temperature to a bright white heat. This makes the carbon porous, and in order to convert into a dense, heavy carbon which is a good conductor and not easily combustible, the vapors of heavy tar oils (dead oil?) are passed slowly over these pieces of glowing carbon, when a deposition of carbon will take place within the pores of the coke.

If the carbon rods are treated with fused sodic hydrate (caustic soda), the silica and alumina will be dissolved as sodic silicate and aluminate, and can be removed by washing with hot water. Oxide of iron and other constituents of the ash are removed with hydrochloric acid followed by pure water.

The simplest process recommended by Jacquelain is to leave them for two or four days in dilute hydrofluoric acid, at ordinary temperature, then wash well and expose for a few hours to a slow current of tar vapors at a high temperature.

Fastest Two Miles ever Trotted.

Two years ago the brown mare Manetta, hooked double to road wagon with the running horse Longman, brother in blood to the great Longfellow, trotted two miles on Mr. Bonner's three-quarter track in 4:35—the first mile in 2:20 and the second in 2:15. Saturday, November 11, hooked to the same wagon (which weighs 155 pounds and has a high dashboard to oppose the wind), she trotted, with Longman as running mate and John Murphy driving, two miles in the extraordinary time of 4:27¼—the first mile in 2:14½ and the second in 2:12¾. The mare did not wear breeching, and therefore, outside of his taking the major part of the weight, she received no assistance from Longman. The track was a trifle dull and slippery. As the two miles are the fastest ever trotted, we give the fractional time:

First Mile.	Second Mile.	Aggregate.
0:34¼	0:34¼	2:48¾
1:07¾	1:08	3:22½
1:41½	1:40	3:47½
2:14½	2:12¾	4:27¼

The first quarter of the second mile, it will be observed, was trotted in 0:34¼, the second quarter in 0:33¼, the third quarter in 0:32, and the fourth quarter in 0:32¾. The last half mile was done in 1:04¾. The pace increased as the distance lengthened. Manetta is ten years old, and by Woodford Bambrino out of Malmaison, by Alexander's Abdallah, sire of Goldsmith Maid. She has trotted a mile to sulky in 1:16¾.—*Turf, Field, and Farm.*

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The "Plateway."

The Liverpool correspondent of the London *Times* gives the following account of a new engineering project, designated "The Lancashire Plateway," which aims at nothing less than the complete revolutionizing of the inland transit of merchandise. The introductory step is to raise a fund of £75,000 for surveys, preliminary expenses, and parliamentary charges; and more than half this amount is said already to have been subscribed. Broadly, the proposal is to lay out a series of roadways, radiating from Liverpool to the centers of manufacturing industry in South Lancashire, to carry along these roadways a double set of iron plates, corresponding in breadth with the wheels of ordinary lorries or wagons, to set the loaded wagons on this smooth plateway, and draw them by steam traction engines to their appointed destination. Passenger traffic is excluded from the scope of the scheme; it is confined entirely to goods, and the anticipation is that it will be possible to carry these at a much lower rate than is now charged by the railway companies. The movement has its origin and motive in the burdensome charges now levied.

The common impression is that railways have both cheapened and accelerated traffic; but such has not been the experience on the main route of South Lancashire. It may appear to be rather a startling fact, yet it is distinctly affirmed that the present cost of sending a bale of cotton from Liverpool to Manchester, by railway, is actually greater than was charged before railways were constructed, and when the conveyance was by canal, or by horse haulage along the highway. Nor is the speed materially quickened. In the old days the journey was completed over night, so that goods dispatched in the evening were delivered early next day; and the railways now do nothing better than this. The loss of time occurs in the handling of the goods at either terminus, and the frequent transshipment they must undergo before being delivered. In the same way, a very large proportion of the expense of railway transit arises from the "terminal" charges—that is, the labor and trouble of loading and unloading the wagons, and marshaling the trains ready for dispatch at the one end and for delivery at the other. The plateway proposes to supersede these ter minal charges altogether, and to dispense with the intermediate handling of the goods, as well as to reduce haulage cost to a point far below anything that the railways can compete with. To understand the character of the change, it may be well to explain the railway system as it now exists, and then to compare it with the plateway system as intended to be established. Take the progress of a bale of cotton from the ship to the mill, as an illustration of the prevailing practice. It is lifted out of the ship's hold, deposited on the quay, again lifted on to a cart, and taken either to a warehouse or the railway station. Arrived at the station, it is once more unloaded from the cart, accumulated in convenient piles in the depot, and finally placed on the railway truck, which, after a long succession of shuntings, is marshaled into its proper train, and is then ready to begin its journey to Manchester. At that end an almost similar process has to be gone through.

The process of the plateway will be infinitely simpler, and, therefore, proportionately cheaper. The bale will be loaded on to the appointed wagon at the ship's side or at the warehouse door, the wagon will be drawn by horses to the nearest station of the Plateway Company, it will be linked on to a long train of other similar wagons, a steam traction engine will be placed at the head of the train, and it will haul the whole train of vehicles along the smooth plateway to the appointed destination. At the further end of the plateway, the traction engine will be disconnected, horses will be yoked to the wagons, and they will at once be drawn to the mill yard. By this treatment all the labor and expense of transshipments will be obviated. The same vehicle that receives the cotton at the Liverpool dock or warehouse will deliver it into the mill without any intermediate handling. This will be a palpable economy. In the case of manufactured goods it will also be a great advantage in the avoidance of the damage now inseparable from rough usage on the railway. But the dispensing with frequent handling is not the sole element of economy. It is proposed to carry the plateway into the outskirts of all the principal manufacturing towns of South Lancashire; at each there will be a stud of horses to take up the work, and thus the plateway wagons will be drawn into each mill yard without loss of time or cumulative charges.

Having now explained the theory of the plateway, it is necessary to see how it is to be applied in practice. Its fundamental principle is that the goods shall never be unloaded or shifted from the wagons in which they are placed from the beginning of the journey until they reach their final destination. If a bale of cotton is loaded at Liverpool, it shall remain in the same condition until it is delivered into the mill at Oldham or Blackburn; if a bale of manufactured goods is sent from these towns for shipment abroad, it shall remain similarly undisturbed until lifted into the ship's hold in Liverpool. This result is to be attained by a very simple process. The wagons or lorries will be similar in construction to those now universally used in Lancashire; the only difference will be in their wheels. The front and rear axles will be of identical width, and of the same gauge as the plate way, but in all other respects the vehicles will be suitable to ordinary roadwork. The plateway will consist of two parallel rows of metals running along the prepared highway. The metals or plates will be about five inches in depth, and along the smooth surface the wagon wheels will run with ease and freedom. On the outer edge of the plates will be a raised flange, strong enough and high enough to prevent the train from leaving the track. In fact, the accustomed railway track is simply reversed. There the rail is flat, and the retaining flange is placed on the wheel; in the plateway the rail or plate carries the flange, and the wheel is flat. The original idea of the promoters was to utilize the ordinary highways for this system of goods traffic, but insuperable difficulties presented themselves, and it is now proposed to acquire land and lay down a special track for the plateway, similar in all respects to the ordinary railways. There will be no necessity, however, to make the permanent way of so substantial construction, or to have the levels so exact as in the case of railways. Although the estimates are still in a very crude form, it is calculated that the plateway can be constructed and equipped at an average cost of £35,000 per mile; if so, the capital will be insignificant in comparison with that embarked on the railways in the same district. This greater cheapness will allow of lower charges, and another substantial gain will be in the smaller working charges. As there will be no passenger traffic, and as the rate of speed for the trains will be comparatively slow, there will be little or no expense in signaling, and the road staff will be slight. The enormous expense of establishing stations in the center of all the large towns (as in the case of railways) will also be avoided, because the depot may be located in the outskirts. This arrangement will only necessitate the haulage of horses for a little greater distance, and will constitute no appreciable addition to the expense of working.

The scheme, as mapped out by the projectors, covers a large portion of the busiest manufacturing districts of Lancashire. The present proposal is to lay down 133½ miles of plateway, at a rough estimate costing about four and a half millions of money. There are two main routes, one starting from the south end of Liverpool, and running to Oldham *via* Warrington, touching the south side of Manchester, and taking in Ashton and Staleybridge. The other route starts from the north end of Liverpool, touching St. Helen's, Ashton-in-Makerfield, Bolton, Bury, Heywood, and Rochdale and, like the other line, terminating at Oldham. There will also be subsidiary lines leaving the main road at convenient points, and branching off to Burnley in one direction and Preston in another. It will thus be seen that some of the principal manufacturing centers of Lancashire are tapped by the plateway, and brought into direct communication with Liverpool. As regards the traffic that now passes between these several points, it is almost impossible to obtain trustworthy statistics. But some idea of the magnitude of the goods traffic of the district may be formed from the fact that every day about 35,000 tons of goods pass through Liverpool; and, unquestionably, a very considerable proportion of it originates with the districts proposed to be served by the plateway. Those who have taken up the subject are confident not only that the scheme is practicable as an engineering work, but hopeful of success as a commercial adventure. This confidence certainly displays itself in a practical form when the preliminary surveys have been completed, a bill drawn for introduction into Parliament next session, and a large guarantee fund already subscribed, not by a speculating syndicate, but by men of the highest repute in the commercial world. The originator of the project is Mr. Alfred Holt, of Liverpool, who, besides being a large owner of steamers trading to India and China, is also a trained civil engineer. He has been working at the project assiduously for two years.

Through the St. Gothard Tunnel by Locomotive.

A correspondent of the *Engineer* writes as follows:

At 10 A.M. we steamed out of the station at Göschenen; at 10 hours 2 minutes we passed under the arch of the tunnel, and at 10 hours 28 minutes we emerged from the corresponding arch into the daylight at Airolo. We were thus twenty-six minutes in traversing the tunnel, and as the length is about nine and a quarter miles, this gives an average speed of about twenty-one miles an hour. As a matter of fact, however, the first part of our journey was performed at a considerably higher and the latter at a considerably lower speed, and that for a somewhat curious reason. It was due to the particular state of ventilation of the tunnel at that particular time. My readers will probably remember the immense difficulties which were encountered in maintaining proper ventilation in the tunnel during its construction, and the many prophecies of equal difficulty to be experienced whenever it became the channel of any considerable traffic. So much did these fears weigh even on the managers of the undertaking, that schemes were mooted for carrying bags of oxygen to supply the drivers with the means of respiration, and designs for working by electric locomotives were seriously entertained. When, however, the matter was put to the test, the difficulty vanished. It was found that at all times there is a difference in the height of the barometer at one side and the other of the great chain of the Alps; the corresponding difference in pressure forms a head of air always acting on one end or other of the great tunnel, and there is therefore a continual current of air through it in one direction or the other, exactly as there would always be a current of water through a pipe connecting two reservoirs with unequal head. This natural ventilation is found more than sufficient for the present traffic of between twenty and thirty trains per day, and there seems no fear that it will ever need to be supplemented. On the particular occasion of my visit the barometer apparently stood higher at the north, or Swiss, portal, by which we entered. Consequently, we were bringing, as it were, the fresh air with us; and certainly for the first half of our journey it was to us on the engine not perceptibly fouler, though somewhat warmer, than the damp and chilly atmosphere of a wet morning at Göschenen. Those in the train had, of course, the benefit of the smoke and gases from our engine, but this was not so bad but that windows could be kept open without special annoyance. The tunnel is guarded by means of brilliant lamps placed at each kilometer, and signaling white for safety and green for danger; and during this first half of the journey I was able, after passing each of them, not only to see the next, but also the next but one, shining like a star of the sixth magnitude just above one of the first. It is obvious that if a light can be seen at 2,200 yards distance, the atmosphere must be more than moderately clear. But after we had reached the summit level, and began to descend toward Airolo, things became different. The atmosphere got thicker and thicker, and soon assumed the character of a white mist, which was vaguely lighted up by the head lamp, and through which the signal lights only became visible when some 200 yards away. At the same time it must be observed that the air, though warm and heavy, was in no appreciable degree sulphurous or choking. In fact, to a Londoner, accustomed to face without shrinking the passage of the "Underground" from Westminster to the City, or from King's Cross to Paddington, the idea of any unpleasantness in the St. Gothard tunnel would have rather the appearance of a joke. The thickness of the mist is, however, somewhat more serious, and it seems open to question whether some species of audible signal might not be substituted with advantage for the lamp. As it was, our driver shut off steam, screwed the brakes on slightly, and went cautiously down the gentle incline at about ten miles an hour. It was as well that he did so, for one of the lamps, when at last we did see it, proved to show green; the brakes were applied and the train nearly pulled up, and we crept at a foot's pace past a gang of laborers engaged apparently in plate-laying. It is in this way that the mean speed of twenty-one miles an hour, at which we traversed the tunnel, is accounted for. If a different system of signaling could be devised, there seems no reason why the speed should not be at least thirty miles an hour, and the transit would then occupy from fifteen to twenty minutes only.

Tungsten Bronzes.

In the arts, tungsten bronzes of different colors are used, namely, golden-yellow, reddish-yellow, purple-red, and blue. The first two crystallize in forms resembling cubes, while the third is obtained partially in cubes and partially in amorphous pieces, and the last named forms prismatic crystals. Other circumstances being equal, the yellow bronze is obtained from mixtures poor in acid, the other two from those containing more acid. But the color is dependent not merely on the composition of the tungstate of soda salt, but also on the amount of tin and on the duration of the fusion, so that when much tin is used and the fusion long prolonged a yellow bronze is obtained from a very acid mixture, and, on the contrary, a salt that is but slightly acid, when fused only a short time and with very little tin, may yield a red or even a blue bronze.

A mixture of two molecules of tungstate of soda and one of anhydrous tungstic acid, with tinfoil slowly added, and kept melted for one or two hours, will yield cubes one half centimeter long (one fifth inch) when 100 grammes (about 4 ounces) are melted, and they will produce a yellow or reddish-yellow bronze, the powder of which seems light brown, and when stirred up with water it imparts to the liquid the property of appearing of a fine blue color by transmitted light.

The red bronze obtained from 10 parts of carbonate of soda, 70 parts of tungstate of soda, and 20 parts of tinfoil yields, on pulverization, a powder that, stirred up in water, transmits green light.

According to J. Philipp, a blue bronze is always obtained if the fused mixture contains more than three molecules of tungstic acid to one molecule of soda; if the fused product is boiled alternately with muriatic acid and with carbonate of soda, the result will be a considerable quantity of fine blue prismatic crystals, with which there are intermixed, in most cases, single red and yellow cubes.

Moreover, all the tungsten bronzes obtained by fusion with tin can also be prepared by electrolysis of fused acid tungstates, but the yield is so small that it is unprofitable.—*Ind. Zeitung.*

The First Telephone.

At a recent meeting of the London Physical Society, Prof. Thomson exhibited an early Reis's telephone made by Phillip Reis, in 1861, at Frankfort, and designed to transmit speech. It was modeled on the human ear, one form of transmitter being a rudely carved wooden ear with a tympan, having a platinum wire behind hard pressed against a platinum-tipped adjustable spring. Prof. Thomson showed by various proofs that words were actually sent by that and similar apparatus.

A Large Refrigerator.

The Quincy Market Cold Storage Company, of Boston, are said to have the largest refrigerating building in the world. It is of stone and brick, 160 by 80 feet in size, and 70 feet in height. The capacity is 800 000 cubic feet, the cost $200,000, and the ice chamber holds 600,000 tons of ice. It will be used for storing dressed beef and mutton. The Chicago refrigerating cars unload at the door.

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IMPROVED VEHICLE AXLE.

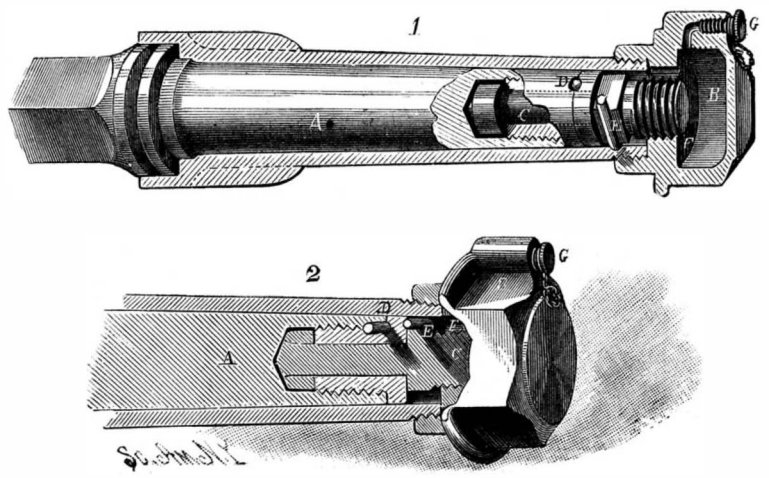
We give an engraving of a novel vehicle axle recently patented by Mr. Edwin Firth, of Providence, R. I. The spindle, A, is provided at its outer end with a revolving pin, C. The end of the spindle has a recess to receive a sleeve in which the pin, C, is journaled, and is provided at its inner end with a flange to hold it in place. The sleeve is screwed in the end of the spindle, and retained permanently in the recess by a pin, D, driven transversely through a groove in the end of the spindle and the wall of the sleeve.

The pin, C, adjoining the end of the spindle is provided with a square enlargement or nut having its outer end rounded and screw threaded. The axle box is secured in the usual manner in the hub. The inner end of the spindle has a flanged collar to receive the inner end of the axle box, between which and said collar there is a washer of leather to prevent sand and grit from entering the bearing. The outer end of the axle box has a transverse pin, E, which, when the hub is adjusted upon the spindle, bears against one of the sides of the nut or enlargement upon the revolving pin, C. It will thus be seen that when the wheel revolves, the pin, C, is caused to revolve at the same rate of speed. The end of the axle box is threaded to receive the lubricating cap or nut, B, which is provided with a diaphragm, having an opening which is screw threaded to receive the end of the revolving pin, C, and provided with grooves, through which the lubricant may pass from the chambered nut or cap, B, to the bearing. This cap has a plug, which is removed when lubricating material is to be supplied to the cap.

The nut or cap which serves to secure the wheel upon the spindle revolves with the wheel, and at the same rate of speed, as though it formed an integral part thereof. By this means the necessity of making right and left hand threads, according to the direction of revolution, is avoided, thus simplifying the manufacture and lessening the expense of production. It is impossible for the nut or cap to come off by ordinary usage. When the nut is screwed into position, it makes a liquid-tight joint at the outer end between the axle-box and spindle, completely covering the end of the latter, and making it impossible for sand and grit to enter the bearing. The nut or enlargement upon the pin, C, as it revolves, creates a vacuum, by which the oil is drawn out of the chambered nut and supplied to the bearing rapidly or slowly, according to the speed of revolution. No oil can be lost or wasted, since it must of necessity pass direct to the bearing.

This improvement is of great service in taking up slack caused by wear upon the spindle. The cap or nut, B, when adjusted, engages threads upon the axle box, and also upon the revolving pin, which forms an integral permanent part of the spindle. The wheel or the axle-box is thus held in a certain position in relation to the spindle. If in this position it becomes loose or slack, it is only necessary to unscrew the nut from the end of the axle box, forcing the latter upon the spindle until tight, and again adjusting the nut, which must then, before it takes with the thread upon the end of the axle box, be screwed down upon the pin, C, a sufficient distance to compensate for the wear.

For further information address Mr. Edwin Firth, 118 Grove St., Providence, R. I.



FIRTH'S VEHICLE AXLE.

A New Cattle Disease.

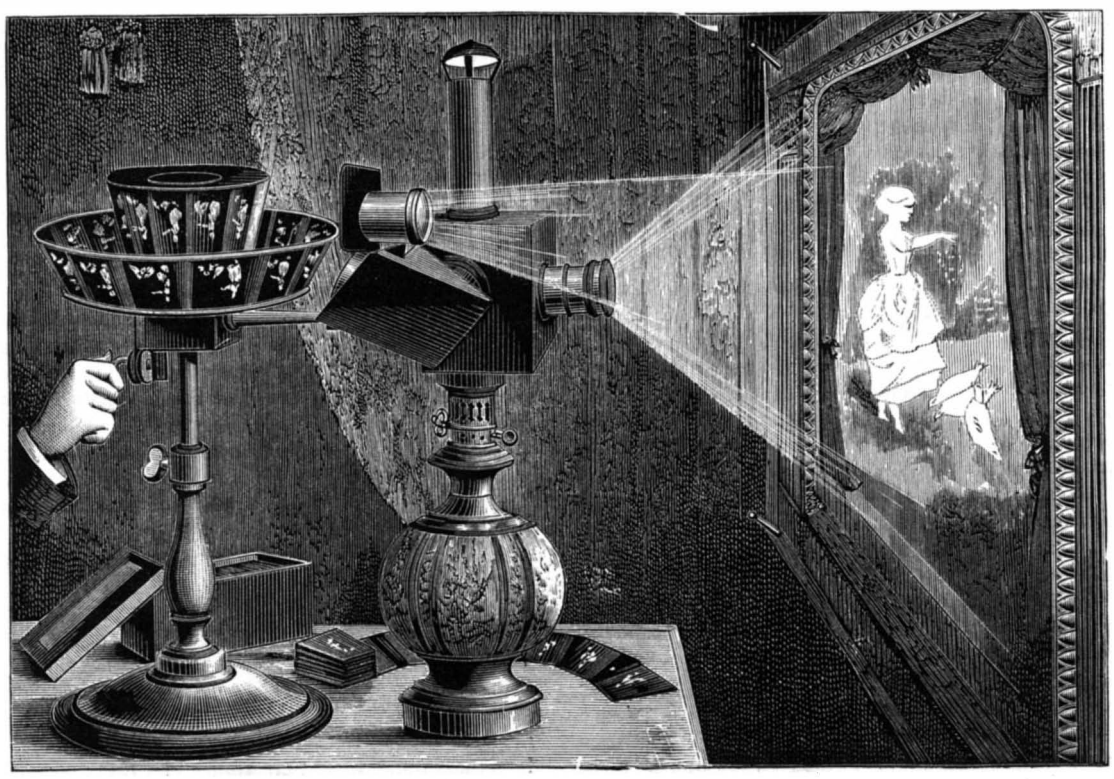
At a recent meeting of the Southern Counties Veterinary Medical Association, held at London, England, Mr. G. Fleming, Army Veterinary Inspector, read a paper on a new disease which he had discovered to prevail extensively, chiefly among cattle, in England, and the nature of which has until now been hidden in obscurity. It manifests itself by great enlargement and induration, as well as ulceration of the tongue. It also attacks the bones of the face and jaws, appears inside and outside the throat in the form of tumors, and is very destructive, especially among young stock. Mr. Fleming, by means of morbid specimens from the tongues and heads of calves, as well as by microscopical preparations, clearly demonstrated the affection to be due to the presence of a minute fungus, which probably obtains an entrance to the tissues either through the mucous follicles or an abrasion in the mouth. From the peculiar manner in which the fungus grows, and the radiating arrangement of its branches, it has received the name of *Actinomyces*, and it is consequently proposed to designate the disease *Actinomycosis*. It has hitherto only been noticed in Germany and Italy, and no fewer than sixteen cases are reported in the German medical journals as having been observed in man. Mr. Fleming produced some evidence to show that the fungus could be successfully implanted from a diseased to a healthy animal; and one of the German cases, in which a man was affected, would lead to the suspicion that it may be communicated from the lower animals to our own species. Instances were given in which the microphyte had also been found in pigs, goats, a horse, and a dog.

Drifts and Tunnels.

These two terms are in common use in mining reports, but are not always correctly used or rightly understood. A drift is a tunnel, but a tunnel is not always a drift. Of the two sorts of mining tunnels, the drift and the cross cut, the former always follows or is intended to follow the vein. When the vein is missed by following a wrong lead, a cross-cut may be necessary to find it again. This is legitimate, but not all cross cuts can be so described. Too frequently, as the *Mining Record* points out, the main object of the cross cut seems to be to eat the treasury stock and "down" mining companies. This operation, our contemporary says, has cost Hillsdale County (Colorado) about $5,000,000 in the past five years. "The cross cut in mining is frequently inevitable, but the mining company that undertakes to determine the value of a prospect by a cross cut tunnel costing from one to thirty thousand dollars is"—not wise.

THE PROJECTING PRAXINOSCOPE.

We have already made known to our readers an optical apparatus constructed by Mr. Reynaud, the "Praxinoscope," which produces with remarkable clearness, by reflection, an animated illusion in the center of a prism of plane mirrors of the successive poses of a person in motion. We have also shown how, in the "Theater Praxinoscope," such illusion is rendered completer by an ingenious arrangement which allows the animated object to appear on an appropriate ground or scene.



REYNAUD'S NEW PROJECTING PRAXINOSCOPE.

The recent remarkable experiments in instantaneous photography, which have permitted the different attitudes of man and animals being caught and fixed, seem to us to give a special interest to this sort of researches, and to consequently call attention to apparatus that allow of such attitudes being brought together after they have been fixed, so as to make a synthesis of them, so to speak, and to thus reproduce the action of life itself.

Such is the purpose of the new instrument that we herewith figure—the "Projecting Praxinoscope"—by means of which the images obtained are projected upon a screen so as to be visible to the entire audience.

By a modification of the lampascope Mr. Reynaud obtains, with the aid of an ordinary lamp, both a projection of the scene (through the objective seen at the side of the lantern) and a projection of the animated object through an objective seen in front and a little above the lantern. To effect this, the poses or phases that form an object are drawn and colored on glass, and united into a band by connecting pieces of cloth. One of these flexible bands is placed in the flaring crown of the instrument, which latter contains apertures that correspond with the poses of the object.

To understand the direction taken by the luminous rays, we must imagine a condensing lens, which, being near the flame of the lamp is not visible in the figure, and also a plane mirror inclined at an angle of 45°, which reflects the luminous fascicle and causes it to traverse the pictures behind the apertures in the crown. This luminous fascicle, which is again reflected by the facets of the prism of mirrors, finally enters the objective, and the latter transforms the central virtual image into a real and enlarged one on the screen.

By making the two parts of the apparatus converge slightly, the animated object is brought into the middle of the scene, where it then seems to undergo its motions as if endowed with life.

A moderate and regular motion is communicated to the instrument by means of a small winch affixed to the support. This apparatus furnishes with an ordinary moderator lamp pictures that are well lighted and that have a very curious effect. It will, then, allow of animated projections being obtained without the aid of a special luminous source, simply by the use of a common, every-day lamp.—*La Nature.*

An Asphalt Mortar.

The *Centralblatt der Bauverwaltung* describes a patented composition made at a factory in Stargard, Pomerania, which has for some years past been used with perfect success on the Berlin-Stettin railway for wall copings, water tables, and similar purposes requiring a waterproof coating. The material is composed of coal tar, to which are added clay, asphalt, resin, litharge, and sand. It is, in short, a kind of artificial asphalt, with the distinction that it is applied cold, like ordinary cement rendering. The tenacity of the material when properly laid, and its freedom from liability to damage by the weather, are proved by reference to an example in the coping of a retaining wall which has been exposed for four years to the drainage of a slope 33 feet high. This coping is still perfectly sound, and has not required any repair since it was laid down. Other works have proved equally satisfactory. In applying this mortar, as it is termed, the space to be covered is first thoroughly dried, and after being well cleaned is primed with hot roofing varnish, the basis of which is also tar. The mortar is then laid on cold to the thickness of about three-eighths of an inch, with either wood or steel trowels, and is properly smoothed over. If the area covered is large, another coating of varnish is applied, and rough sand strewn over the whole. The waterproof surface thus made is perfectly impregnable to rain or frost, and practically indestructible. The cost of the material laid is estimated at not more than 5d. per square foot; and it is stated that this price can be reduced by at least 1d. for large quantities put down by experienced workmen.

How Hogs Prevent the Renewal of Pine Forests.

A correspondent writing from Johnsonville, S. C., incidentally mentions a curious instance of the influence of animals in controlling or preventing forest growths. It appears that the fondness of hogs for the juicy roots of young pines leads them to seek them assiduously, so that where hogs are allowed to roam in that region one can hardly find a young long-leafed pine in a thousand acres of pine forest. There being no young trees to take the place of the old ones used up by the lumbermen and turpentine gatherers, that species of pine timber is rapidly being exterminated.

A FRENCH chemist claims to have discovered a method of overcoming the danger threatening vineyards from the ravages of the phylloxera. His process is to inoculate the vines with the phenol poison. The phylloxera do not attack plants thus treated, and are extirpated for want of food. The vines are in no way injured by the inoculation process.

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The Distribution of Carp.

The United States Fish Commission have been distributing large numbers of young carp for stocking ponds in various parts of the country. Over 40,000 were sent out during the first ten days of November, and from 50,000 to 60,000 more were awaiting distribution. Among the earlier shipments were 1,000 to Pennsylvania, 2,000 to New York, 6,600 to New England States, 1,200 to Ohio, 12,400 to Kentucky, 1,600 to Virginia, and 16,000 to Iowa and Minnesota.

In reply to inquiries by a correspondent of the *Tribune*, Professor Baird said that from 12,000 to 15,000 carp ponds in all have been stocked since the commission began the work. About 10,000 applications were then on file from different parts of the Union, and new applications were constantly received at the rate of fifty to one hundred a day. As the value of the carp for food, the ease with which it is kept, and the rapidity with which the species multiples, as well as that of its growth, become known in a country or neighborhood, the demand for young fish to stock new ponds of course increases. The hardy constitution of the carp renders its transportation alive and in good condition from place to place an easy matter, and is another strong point in its favor. Small tin buckets partly filled with water are now extensively used for this purpose. Each of these buckets has a capacity of about one gallon, and is fitted with a cover, in which are two small holes for the admission of air. Twenty young fish can make a long journey by express in one of these buckets very comfortably without a change of water. A year or two ago, as an experiment, a common tin bucket containing a few live carp was sent by express to Commissioner Blackford, in New York, with a request that if the fish were alive when he received them he would reship them to Washington without changing the water. He did so, and when they reached Washington again, after a week's absence, the fish were found in good condition and did not appear to suffer after remaining another week in the same water, although the bucket stood in a warm room in the meantime. The small buckets mentioned are much used in sending carp to individual applicants not too remote from Washington. Where a number of applicants live in the same vicinity a dozen or two dozen buckets are packed in a strong wooden crate and sent by express. For larger shipments ten gallon tin cans are used, one of which will accommodate from 150 to 200 young fish.

It has been found by experience that the young fish taken from the water in the spring appear to be more tender and do not bear transportation so well as those taken in the autumn. It is found, too, that the growth of the carp in the South is about twice as rapid as in the North. There is a carp now at the Smithsonian Institution which, as a young fish an inch or two in length, was sent to Georgia and placed in a pond where it remained less than a year, when it was sent back to Washington weighing seven pounds. In the latitude of New York and New England, one of Professor Baird's assistants informed the correspondent the average yearly increase in weight the first year is about three to three and a half pounds. Carp weighing from three to six pounds are occasionally seen on the tables of fish dealers in the Washington markets, having been taken in the Potomac, into which it is supposed they escaped during a season of high water when the carp ponds were invaded by the river. These fish are esteemed a delicacy and sell at good prices.

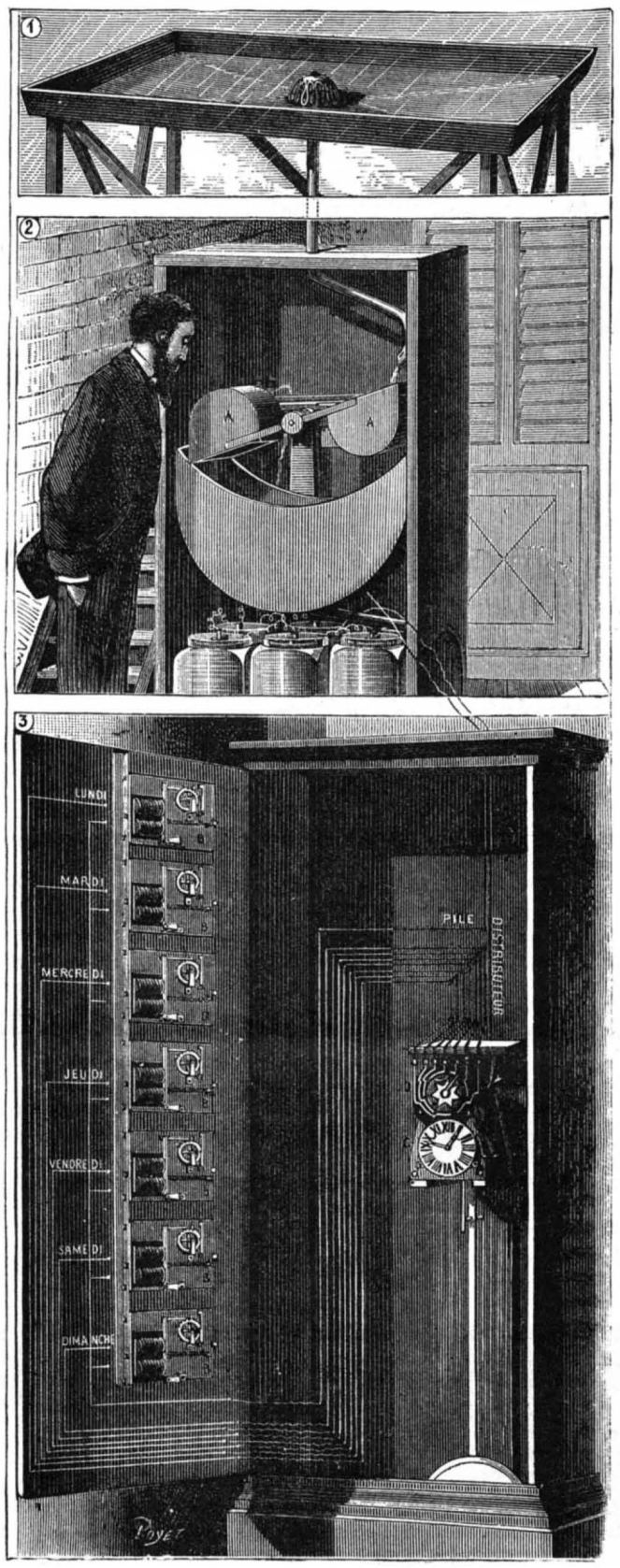
The Weehawken Tunnel.

The bore through the Palisades of the Hudson River, at Weehawken, N. J., opposite New York city, is now complete, though it will probably take six months more of work to finish the tunnel and its approaches. The eastern approach has been cut through solid rock a distance of 150 feet. Its width is 56 feet. The tunnel is 4,000 feet in length, 27 feet wide, and 21 feet high. The greater part of the cutting, 3,400 feet, has been done since January, 1882. The estimated cost of the tunnel was about $1,250,000; but it is thought that the actual cost will amount to much more. The tunnel has been cut in sections, the inner ones from five shafts from the upper surface of the bluff. These shafts, which have an average depth of about 150 feet, will be useful for ventilating the tunnel. Seventy compressed air drills have been constantly employed. A recently invented and very powerful steam shovel has done effective service in removing material and loading cars.

It is estimated that this year's output of the Wood River and Sawtooth mines in Idaho will be about $3,000,000, or double the yield of the entire Territory three years ago.

A Large Driving Belt.

P. Jewell & Sons, Hartford, Conn., have lately finished a four ply belt, 124 feet long, 38 inches wide, and 1 inch thick. It weighs 1,834 pounds. This belt is intended for a rolling mill in the Washburn & Moen Wire Works, Worcester, Mass., and is expected to transmit more than 1,600 horse power from a 24-foot pulley to a 10-foot pulley, with a belt speed of 5,200 feet per minute, almost one mile. The belt is made of the thickest and best selected hides, four of them making the thickness of the belt. These thicknesses are secured by rivets, and the joints by "scarf joints" cemented.



Figs. 1, 2, and 3.—PLUVIOMETER AT THE COMPTOIR D'ESCOMPTE, PARIS.

METEOROLOGICAL APPARATUS AT THE COMPTOIR D'ESCOMPTE, PARIS.

Among the clockwork and meteorological apparatus installed in the "Pas-Perdu" hall of the Comptoir d'Escompte, of Paris, there are a few that have appeared to us to be sufficiently interesting to be brought to the attention of our readers. Among these are a pluviometer and an electrical anemoscope, which, thanks to the kindness of M. Collin, the inventor and manufacturer of one of them, we have examined in detail. We give herewith a sufficiently complete description of them to allow their operation to be understood.

The arrangement of the building precluded the idea of causing the rain to directly actuate the registering mechanism, and the distance from the roof to the apparatus necessitated a series of conduits which, through their length, would have retained an appreciable quantity of liquid, and made the indications of the pluviometer inaccurate. For this reason M. Collin pursued his researches in another direction, and finally decided upon the electrical system, whose arrangement we shall now describe.

The apparatus consists of three parts: (1) a reservoir of given surface for receiving the rain; (2) a distributer; and (3) a registering receiver—the two latter being connected with a pile by an electric circuit.

The reservoir (Fig. 1), of a superficies of one meter, designed to collect the rain, is placed on the roof. Immediately beneath it, in the top story of the building, is installed the apparatus which we call a distributer, and into which flows the rain water that actuates it by its weight. This apparatus (Fig. 2) consists of an axle revolving upon two bearings, and carrying, fixed by the middle, an arm at each of whose extremities is adapted a small bucket, A. In a normal state the arm is almost horizontal, and there is always one bucket in a position to receive the rain water coming from the collector on the roof. Upon the same axle there is a piece with four cams, upon which there acts, to hold the axle, a lever carrying a regulating weight. This lever allows the axle to revolve under the influence of the weight of water contained in the bucket only under a pressure of a weight of 500 grammes, this corresponding to a layer of water of a half-millimeter in depth over a surface of one meter. Then every time a bucket turns over and empties, a half-millimeter has fallen on the roof.

Upon the same axle, again, there is a small ebonite cylinder carrying two strips of metal, two millimeters in width, set longitudinally into the whole length of the cylinder. Perpendicular to the axle there are two insulated strips of metal, carrying two terminals for the electrical circuit. The extremities of these strips rub over the cylinder without making a contact between them; but, when the axle in revolving presents one of the metallic parts to the friction of the strips, the latter became united metallically, and the rotary motion of the axle is shown by a closing of the circuit.

The receiver (Fig. 3), located in the grand hall on the ground floor, consists of a series of seven sets of wheelwork, B, B, B, etc., analogous to the counters employed in electrical clockwork. To each of these there is adapted a dial (seen externally in Fig. 6) which carries one of the following inscriptions: *Monday*, *Tuesday*, *Wednesday*, etc., up to *Sunday*. These dials are divided from 1 to 20 by figures, between which are a certain number of points, the figures representing millimeters and the points semi millimeters. The mean of the rain that falls per 24 hours in the latitude of Paris being 15 millimeters, this division is sufficient. It is upon these dials that are registered the electric currents sent by the distributer; but the rain that falls on Monday must be registered on the one carrying such an inscription, and so on for all the rest. To effect this, a clockwork regulator, I, whose mechanism actuates a circular commutator, D (Fig. 3), receives the electric currents coming from the distributer, and transmits them to the receiving dial that corresponds to the proper day. This commutator is arranged in the following way: Upon an ebonite disk there are fixed seven arcs of a circle, the unition of which constitutes a flat ring, each part of which is insulated and carries a terminal to which is attached a wire that runs to one of the seven receiving dials. In the center of the seven metallic parts there is an insulated axis to which is attached the copper wire coming from a pile whose zinc wire is connected with the distributer. This central axis is moved by a jumper that makes it revolve a seventh of a revolution every twenty-four hours, at midnight. It carries an index, or, better, a flexible strip whose extremity rubs against the arcs. The electric current sent by the distributer (Fig. 2) enters the regulator, C, then (Fig. 3) through the central axis, and escapes

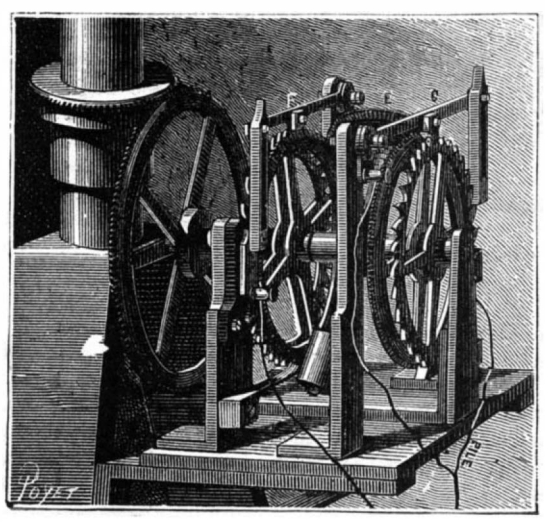


Fig. 4.—DISTRIBUTER OF THE ELECTRICAL ANEMOSCOPE.

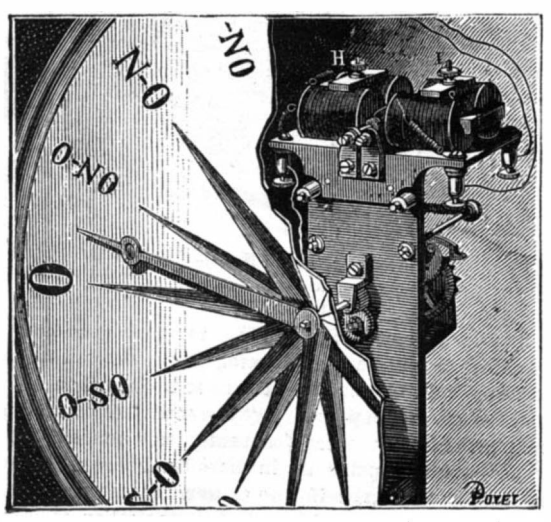


Fig. 5.—RECEIVER OF THE ELECTRICAL ANEMOSCOPE.

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through one of the seven terminals, and this directs it to one of the seven counters, B, upon whose dial it is registered.

The indications that show the quantity of rain that has fallen remain, then, upon the dials; and these, in order to furnish new indications eight days afterward, must be set again at zero. For this purpose the commutator is made to act by double contact, and, at the instant at which it causes the circuit to pass from the Monday dial into that of Tuesday, for example, it sends into the latter a current that has the effect of ungearing the wheelwork and allowing a spiral spring to carry the index-hand back to the zero or starting point.

M. Collin has not had time to render his apparatus complete by adding to it a totalizing counter, which, connected with the line wire, would have indicated the passage of all the currents coming from the distributer and passing into any one of the dials. In this way there would have been obtained the total quantity of rain that falls during the year, without the necessity of transcribing each week the indications of the seven dials.

The electrical anemoscope which we shall now describe, and which is the invention of M. Bisson, consists of two apparatus, a distributer (Fig. 4) and receiver (Fig. 5). The former of these, which is located in the cupola of the campanile, is arranged as follows: Upon the rod of the weather vane, which enters into the interior of the cupola, and which, revolving upon an agate, participates in the motion of the vane, there is mounted a horizontal cone wheel that gears with a second and vertical one. This latter is mounted upon an axle which carries at the same time a planet wheel, E, that gears with two like wheels, F and G. These latter are loose on the axle to which the planet wheel is fixed. As the result of such an arrangement, in the motions of the planet wheel around the axle if one of the wheels, F, G, is held, the other is carried along, and *vice versa*. Each of the wheels, F, G, carries a ratchet wheel, upon which rests a contact lever that performs at the same time the rôle of a click, so that the motion of the vane in one direction or the other can carry along only one of the two wheels, and consequently send electric currents brought about by the contact levers only into one of the two line wires that start from the latter to go to the receiver. The keys which close the circuits with the lever are connected with an ordinary electric pile.

As we have just seen, the motion that actuates the wheels, F, G, comes from the central axle, which is itself carried along by the rod of the vane.

The receiver (Fig. 5) is constructed upon the same principle, which allows of a circular motion to the right or left; but, as it is necessary to reproduce here the motions of the vane exactly, that is to say, those of the axle of the planet wheel, operations take place in an opposite way. To effect such a result, two electro-magnets have their armatures arranged so as to actuate two wheels like those of the distributer (F and G), although here these wheels have no contact levers or ratchet wheels, the armatures performing the part of clicks. The line wires starting from the distributer terminate at these two electro-magnets, whose second wire is fastened to the pile. The two wheels that are actuated by the electro-magnets gear with a planet wheel whose axle communicates its motion to an index, which, representing the vane, indicates upon a rose the direction of the wind.

The mechanism, instead of being carried along by the axle, as in the distributer, is moved along by the action of the armatures upon the wheels and planet, all the angular motions of the vane producing series of electric currents that bring about like angular motions of the index, whatever be its direction.

Fig. 6 represents the registering apparatus located in the Pas-Perdu hall of the Comptoir d'Escompte, and which, thanks to the mechanism that we have just described, permits the public to be constantly informed as to the direction of the wind, the quantity of rain that has fallen, and the state of the temperature.

Opposite the case containing the registering apparatus there is another, the counterpart of it, which supports a clock that gives the phases of the moon by multiple dials, and the hour in the principal cities of the world. In the anemoscope case there is also a barometer.—*La Nature.*

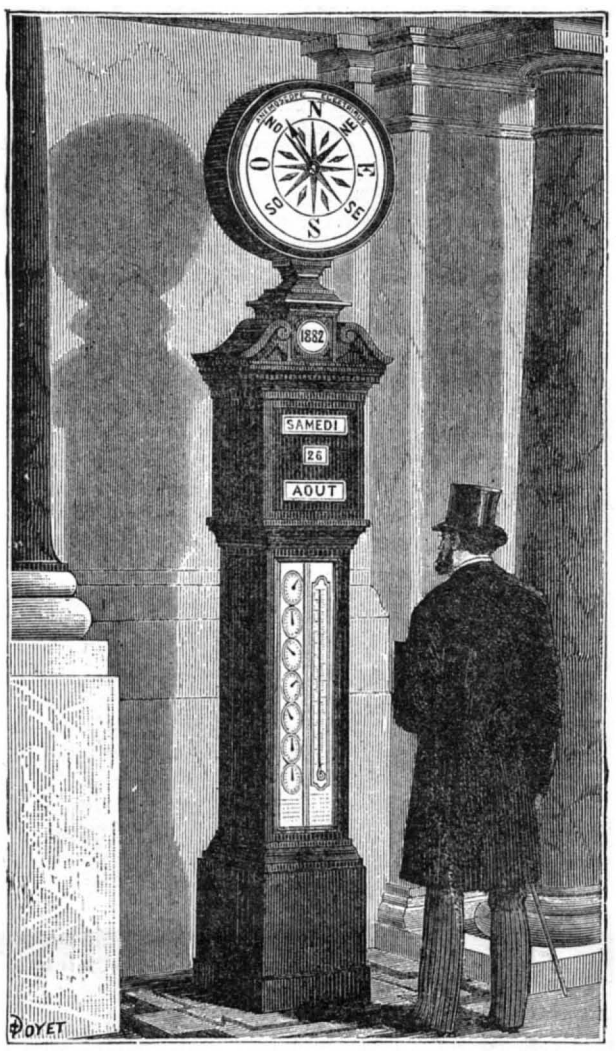
The Sixth Sense.

At a recent meeting of the Anthropological Institute, London, Mr. Francis Galton, F.R.S., exhibited and explained some apparatus contrived by himself, with a view of testing the muscular and other senses. This apparatus consisted of a box, something like a backgammon board, containing trays of weights arranged for measuring the relative delicacy of the muscular sense (the sixth, added by modern psychological science to the five recognized by the ancients) as existing in different persons.

The principle Mr. Galton claimed as a new one. It established, he said, a graded scale of sensitivity, and was applicable, by means of analogous methods, to testing the delicacy of other senses, such as taste and smell. He employed small weights arranged in sequence, which were numbered in succession 1, 2, 3, etc., and differed by equally perceptible variations, as calculated by Weber's law. Hence if a person, A, could just distinguish, say, 1 and 3, he could also distinguish between any two weights two grades apart, as 2 and 4, 3 and 5, etc. Again, if another person, B, were twice as obtuse as A, he would be able to distinguish one grade only where A could distinguish two. In other words, he would be only just able to distinguish between weights 1 and 5, 2 and 6, and so on.

Generally, the number of grades between the weights that any person could distinguish had to be found by trials, and that number became the measure of the coarseness of his sensitivity. The weights used were blank cartridges, filled with shot and wadding, care being taken that the shot should be equably distributed. They were arranged in trays, each tray holding a sequence of three. The person tested had to arrange the cartridges in the tray handed to him in the true order of their weights.

Some provisional results of the plan were mentioned. One was that men had, on the whole, more delicacy of discrimination than women; another, that intellectually able men had more than other men. It further appeared that women sensitive to a morbid degree were not remarkable for their powers of discrimination. Sensation was produced in them by a feeble stimulus, and so was pain, but the intervening numbers of just perceptible differences did not appear in their case to be exceptionally large.



METEOROLOGICAL APPARATUS IN THE GRAND HALL OF THE COMPTOIR D'ESCOMPTE.

JUMPING SEEDS.

These "flea seeds" were brought to notice some time ago, and were described at length in the *Mining and Scientific Press* and *Pacific Rural Press*. It seems, however, that they have made their appearance in Butte County, and are the object of some curiosity, being considered something new. As a matter of general information we give an illustration of the "seed" and the insect, and extract from the report of C. Mason Kinne, of the San Francisco Microscopical Society, who followed their development through to the perfect insect. He says:

JUMPING SEEDS.

"The seeds are very minute, presenting the appearance of a mustard seed, and are of a brown color. On placing them in the open hand the 'seeds' jump about from one place to another in a very lively manner. Even when in a phial or small bottle the same characteristic is manifest, and, as they were somewhat peculiar, the 'flea seeds' have attracted considerable attention.

The gall or cocoon is found lightly attached to the leaf of the oak, and in time falls to the ground, when the noise occasioned by the thousands leaping about, without any apparent cause or organs of motion, sounds very much like the falling of fine rain on the leaves. An examination shows that the extraordinary activity displayed is caused by the spasmodic contraction and concussion of the abdominal parts of the occupant against the side of the shell, which movement does not cease even after the covering is nearly split in halves, if the tender structure of the chrysalis be not injured. That it is the chrysalis and not the larvæ has been shown by the microscope, and its change to the perfect insect has been noted at weekly stages."

The average length of the insect is five-hundredths of an inch, and in each has been found from 60 to 80 pear-shaped ova. The engraving gives its general appearance, with wings raised somewhat unnaturally, for the purpose of showing their size and shape. It was drawn on the wood, from the microscope, by Mr. Kinne, and is enlarged twenty diameters. Its ovipositor is a tiny, though perfect, piece of nature's mechanism, and lies incased in a sheath at the lower part of the abdomen. Mr. Henry Edwards, of the Microscopical Society, furnished the following technical description of the curiosity:

"GENUS CYNIPS—*L. Cynips saltatorius* (nov. sp.).—Black, shining. Head broad between the eyes, which are very prominent. Antennæ fourteen, jointed, the first and second joints being much swollen, and the third joint larger than the other two; the remaining joints are long, simple, and nearly equal. Thorax densely but finely punctured, very globose in front, projecting so far as to almost hide the head. Abdomen globose, shining. Ovipositor cases short, spatulate, received into marginal groove in the body. Ovipositor itself flesh color, curved inwardly toward its middle. The abdomen is six-jointed. Terminal joints of palpi hatchet shaped. Tarsi very hairy throughout, the anterior pair with six and the remainder with seven joints. Coxæ very globose. Tibiæ long, with large and powerful spines at the base."—*Mining and Scientific Press.*

Meerschaum.

This well-known mineral, which consists of silicate of magnesia and water, part of which is hygroscopic and part chemical combined water, is chiefly obtained, says the *Industrie Zeitung*, from near the city of Eski-Scheir, in Asia Minor, where it was mined on a large scale even before the time of the Turks. The city is surrounded by a basin, or depression, which was in all probability a large lake, now dried up. All around the borders of this basin are found masses of meerschaum mixed with pebbles and bowlders in a sort of red earth. The stratum forms an angle of 45° with the hill. Between every two strata of pebbles, which are sometimes interrupted by a stratum of earth, there is found a layer of meerschaum. The meerschaum frequently envelops a block of gravel or piece of quartz rock.

The blocks of meerschaum when first mined are wet and dirty, and to fit them for export they must have the earthy crust removed and be dried, polished, and refined. The refining of a lot of one hundred chests requires two months' work on the part of twelve or fifteen persons, and costs about 1,200 florins ($600). The average price at Eski-Scheir for a chest of merchantable ware has varied since 1873 between 160 and 250 francs, and last year (1881) it was 161 francs ($32.20), while the refuse, fit only for converting into a plastic mass, could be had for 23 to 35 francs.

Ten qualities of meerschaum are recognized, and each is to be had of four different sized pieces. A chest 30 inches long, 8 inches wide, and 15½ inches deep will hold from 25 to 40 of the largest sized masses, 100 to 150 of the second size, 200 to 250 of the third size, and 450 to 650 of the smallest.

In the last two decades the exportation of meerschaum has varied considerably; amounting to only 3,000 chests in 1855, and rising to 9,500 in 1870; in 1875 it fell to 8,300, and rose again to 11,100 in 1881.

This quantity is handled by fifteen firms in Constantinople, comprising Austrians, Bulgarians, Greeks, Armenians, and Turks. These send their ware to branch houses or consignees in Vienna, which is the only established market for this article. Vienna's immense importation of meerschaum dates from the middle of the year 1850, when the production of pipes and cigar holders received an immense impetus from the exportation to England, France, and America. At the beginning of 1860 a considerable export of pipes to San Francisco began, while at the same time large quantities of cigar holders were sent to Australia and America *via* Hamburg. Since then the conditions have changed, for the introduction of this article into America has been checked by high tariff duties. By the aid of Austrian workmen that have emigrated thither, an industry has been founded in America which competes successfully with the Vienna pipe manufacturers, of which America was formerly the largest customer. The United States, like France and Germany, obtain most of their raw material from Austria.

Siegfried Adler, in a recent book on Constantinople and its neighborhood, says that for the last ten years there has been a steady decline in the meerschaum business, part of which is attributable to an unstable currency in the place where it is found.

SINCE 1850 eighty-two people have thrown themselves from the Vendome column in Paris.

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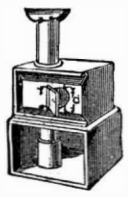
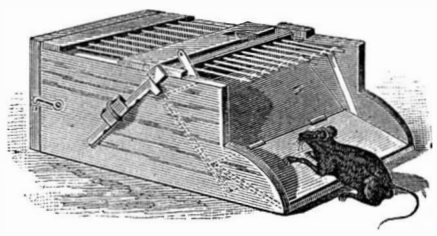
Improved Polyopticon.

In this device the object is to highly illuminate a picture placed at the side of a box or camera, and cause it to be reflected upon a screen in a dark room, the picture being in the process greatly magnified by a lens. By regulating the distance of the instrument from the screen, a small photo or other picture can, it is claimed, be made to appear on the screen of life size or larger, and it can therefore be made practically useful in art work for enlarging designs, etc., as the more expensive wonder cameras have mainly been employed. For business or pleasure it is available to a large number of persons who could not afford the more expensive but less convenient imported cameras. Further information may be obtained by addressing the Murray Hill Publishing Company, 129 East Twenty-eighth Street, New York city.



Improved Animal Trap.

This is a self-setting animal trap, having a box of any suitable size, closed at its rear end by a door, which is wired, as shown, and at the top by the wires which are made fast at their rear ends in a crosspiece, and at their forward ends in a central crosspiece. In front of the crosspiece and near it is journaled in the upper edges of the side pieces of the box, a rock shaft carrying a series of wires, which are of a length about equal to the depth of the box. The shaft is connected by means of an arm and connecting rod to a board, which is hinged to the bottom of the box. On one end of the shaft, outside of the box, is fixed an arm, which is so weighted as to normally hold the shaft so that its wires will be held in a horizontal position, and the hinge board in an inclined position. A tip-up board is pivoted to the hinge board, and arranged so that, when the trap is sprung by an

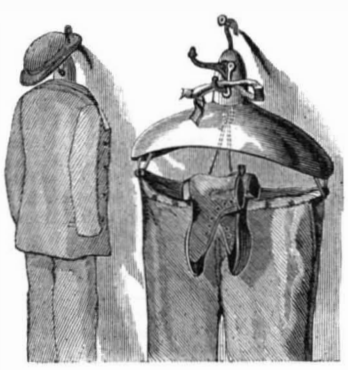


animal, the rear end of the tip-up board will be thrown up, frightening the animal into the box. There is a housing for the bait hook, which protects the bait on the hook from the caught animal. The weighted arm will normally hold the trap set until an animal walks up the board to the bait, and attempts to detach it from the bait hook. This will release the detent, whereupon the weight of the animal, overbalancing the weight of the lever, will cause the board to drop, the tip-up board to rise, and the wires to be swung down into a vertical position, cutting off all retreat of the animal and causing him to jump into the box. The weight of the animal having now been removed from the board, the weight of the arm will turn the shaft and reset the trap ready for the next animal, and prevent all possible escape of the animal in the box. This invention has been patented by Mr. Benjamin F. D. Miller, of Wooster, O.

Suit Hanger.

This is a suit hanger with attached devices for hanging or carrying if necessary an entire suit of clothes, and for keeping them in perfect shape, free from breaking down.

The suit hanger is made to conform in shape to the chest and shoulder portion of the body. It is made of sheet metal, with a neck projecting up from it, having at its top a hook, by which the whole is suspended. Secured to the interior of the hanger, and arranged to project below it, are two close bent wire pantaloon hangers, made with contracted necks, so as to receive opposite side buttons on the waist portion of pantaloons, so that the pantaloons are hung in a spread condition.



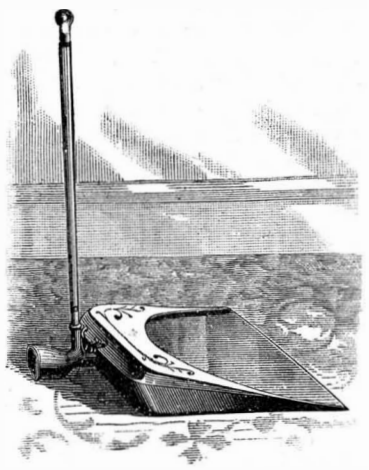
The body part of the hanger serves to receive over it the vest, coat, and, it may be, overcoat of the suit, all of which may be secured on or be prevented from falling off the hanger by buttoning them by their upper buttons thereon. These several garments may be kept smooth or unbroken in their original and proper form, and the shoulders of the coats and the entire suit, in fact, be retained in shape till worn out.

A hook for suspending a pair of shoes is fastened to its bottom, and attached to the front of the neck is a hook for hanging on a hat, and a smaller hook for receiving within it a collar and necktie.

This invention has been patented by Messrs. G. N. Werntz and Henry L. Lemert, of Dresen, O.

Improved Dust Pan.

This dust pan is capable of being held by the foot while the dust, crumbs, or other substance to be removed is swept into it. The pan has a toe-socket for the foot in its handle, and a branch socket for the insertion of an upright removable handle to facilitate the use of the pan. The improvement renders the stooping of the person while using the pan unnecessary. This will be found of great benefit by persons having weak backs, or women in delicate health, and to whom stooping is injurious. With this improvement both hands are left at liberty to ply the broom. This invention has been patented by Annie M. H. Moss, of Monroe, Conn.



Falling from Heights.

With regard to the recent sad suicide of a girl by leaping from one of the towers of Notre Dame, Dr. Bronardeli's expressed view that asphyxiation in the rapid fall may have been the cause of death, has given rise to some correspondence in *La Nature*. M. Bontemps points out that the depth of fall having been about 66 meters, the velocity acquired in the time (less than 4 seconds) cannot have been so great as that sometimes attained on railways, *e. g.*, 33 meters per second on the line between Chalons and Paris, where the effect should be the same; yet we never hear of asphyxiation of engine drivers and stokers. He considers it desirable that the idea in question should be exploded, as unhappy persons may be led to choose suicide by fall from a height under the notion that they will die before reaching the ground. Again, M. Gossin mentions that a few years ago a man threw himself from the top of the Column of July, and fell on an awning which sheltered workmen at the pedestal; he suffered only a few slight contusions. M. Remy says he has often seen an Englishman leap from a height of 31 meters (say 103 feet) into a deep river; and he was shown in 1852, in the island of Oahu, by missionaries, a native who had fallen from a verified height of more than 300 meters (say 1000 feet). His fall was broken near the end by a growth of ferns and other plants, and he had only a few wounds. Asked as to his sensations in falling, he said he only felt dazzled.

The Discovery of Grape Sugar.

At the present time, glucose, or artificial grape sugar, is being made in such quantities, and so much has been said and written for and against it, some regarding it as identical with the natural sugar of fruits and honey, others as differing from it physiologically, if not chemically, that our readers will be interested in the early history of the substance. The first mention of it was made by T. Lowitz in an article published in Crell's *Chemische Annalen* for the first half of the year 1792. This journal, then one of the leading scientific periodicals, is now so scarce that no public library in New York city is in possession of a set of it.

Lowitz discovered a peculiar kind of sugar in honey, and gives in that journal a quaint but interesting description of the manner in which he discovered and prepared it.

We may conclude, says Lowitz, that honey owes its sweetness to the abundance of sugar that it contains, but that no one knew how to separate this from the other constituents. This separation was the chief object of his experiments. First he succeeded in removing the peculiar taste, odor, and color by filtering the diluted honey over charcoal, but on attempting to concentrate the solution by evaporation, it turned brown and showed no tendency to crystallize.

After several months, he continues, there appeared in my honey, which had been treated with charcoal and again concentrated, some very small, white, shining bodies of crystalline nature, which gradually increased in quantity, and finally filled out, for the greater part, the whole mass of the honey. In order to be able to investigate the nature of this granular substance, it was necessary to carefully remove from it the brown, thick, sticky substances. This succeeded best by washing it with cold, highly rectified spirits of wine (alcohol). I was delighted to see that, by mixing strongly together, the alcohol dissolved the adhesive matter without perceptibly attacking the white granular particles, which were finally entirely cleansed from it by frequent washing with fresh alcohol. The sugary substance that remained on the filter, after gently drying, could be rubbed to a fine and perfectly white powder, which did not attract moisture from the air and possessed an agreeable sweet taste.

The author goes on to state that all his efforts to obtain regular crystals were fruitless, that the crystalline masses always resembled cauliflowers (or warts) and consisted of very fine needles. He also found that the solution was turned brown by lime water, and after precipitating the lime, an acid remained. This sugar was also decomposed by other caustic alkalies, he says. After discussing the difference in the action of this sugar and other sugar toward alkalies, Lowitz adds that the other substance extracted from the honey sugar by alcohol differs from it in no other respect except that it cannot be obtained in a dry form by any means; that to this latter substance honey owes its property of turning brown by heat, for when the honey sugar has been freed from it the solution can be boiled over the fire without browning. Moreover, this sweet, sticky substance resembles honey sugar in all other properties, as well in taste as in its action toward caustic alkalies and quicklime.

He concludes with the assertion that there is no hope of our ever being able to make sugar from honey, as something more is necessary than to merely remove the foreign substances.

Reading these remarks with the light that ninety years of research have thrown upon them, they stand forth as remarkable instances of correct observation. The crystals which he obtained were dextrose, or ordinary glucose, while the uncrystallizable sugar is now known as levulose, a mixture of the two constituting fruit sugar as it exists in honey.

Ten years or more elapsed before Kirchhoff discovered the now important fact that this form of sugar could be made from starch by the action of dilute acids; and a half a century rolled away before the manufacture of sugar from starch became one of the large—very large—chemical industries.

Overproduction of Lead.

The following from the *Mining Journal* does not present an encouraging prospect to lead producers. It says that both lead and spelter are steadily continuing on their downward course, and so far as the former is concerned, the outlook is discouraging. Production has been stimulated in an exceptional manner during the last few years, and much capital that was invested in the development of mines and in the building of smelting works has been beginning to show returns in the shape of base bullion. It is not alone the great plants of Colorado, Utah, and Nevada, the existence of which is known to all, but also the large number of small establishments in many mining camps in the West, which are swelling the make of lead. Under this pressure, lead has gradually receded. In pure metal to-day, it can be readily obtained for four and a half cents. The question which all interested in the metal are anxiously attempting to answer is, whether an accumulation will continue. It is true, on the one hand, that the business season for the consumers of lead has passed by; that in sympathy with business in general, building has fallen off; and that corroders have been persistently limiting stocks in course of manufacture. On the other hand, it must not be forgotten that a very large number of the small smelters are located in inaccessible regions, where the supply of raw materials is difficult to get; that few of them have capital enough to buy large quantities of ore and fuel and stack the base bullion besides. Even the large smelting works are affected in the same way, and a restriction of the output may result equal to the reduction in the consumption. These circumstances should not be forgotten at a time when there is a disposition to look only at one side of the question; still, the outlook is gloomy enough, and it is only too likely that the bottom has not been reached.

Commercial Effects of the St. Gothard Tunnel.

The *Continental Gazette* says that the opening up of the St. Gothard route is changing the commercial relations of the countries north and south of the mountains with almost revolutionary rapidity. So long as the formidable Alps remained unpierced, Italy was cut off from direct overland communication with Central and Northern Europe, and its commerce was very largely limited to transactions with Great Britain and France. The Gothard Railway is changing that state of things with unexpected rapidity, and is throwing the Italian trade into the hands of Germany, Belgium, and Holland. The through railway service brings early fruit and vegetables without transshipment from all parts of Italy to Ostend, Antwerp, and Rotterdam, whence they are conveyed by fast steamers to London and other English ports. The Great Eastern Railway Company alone is stated to have carried over 6,000 tons of these goods *via* Antwerp and Harwich in a few months. Malta is thus also brought nearer, and Algerian produce, such as green peas and early potatoes, is made more available.

In the other direction, Italy is receiving an unprecedented, not to say overwhelming, amount of attention from Germany. In the first two months after the opening of the Gothard route, the Germans dispatched 40,000 tons of coal, 107 tons of unmanufactured iron and hardware, 14,000 tons of machinery, 693 tons of copper, 17,409 tuns of spirits, 1,446 tons of paper, and 76 railway wagons—of all of which articles the previous exports had been either *nil* or quite nominal.

Ice Houses and Ice Boats.

The usual annual inquiry as to the construction of ice houses and how to build ice boats has commenced. The best information to be had as to the first (ice houses) may be found in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 55, 59, 99, 116; and as to the last, engravings and full instructions as to the building of ice boats may be found in the following numbers of the SUPPLEMENT: 1, 54, 61, 63, 70, 220, 214. To be had at this office or of newsdealers, price 10 cents each.

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ENGINEERING INVENTIONS.

Mr. Nathan M. Hale, of Grand View, Tex., has patented an improved car coupling in which the coupling link is made in two U-shaped parts, pivoted together, and sustained in coupling position by springs.

An improved stock car has been patented by Mr. George F. Oehrl, of Belle Vernon, Pa. This invention is an improvement on the stock car for which United States Letters Patent No. 253,418 were issued to the same inventor on the 7th of February, 1882.

Mr. Edward Ebi, of Cedar Rapids, Ia., has patented an improved device for applying all the brakes of a train simultaneously. The invention consists in a rotating brake rod journaled below the car bottom, and provided at the ends with clutch plates longitudinally movable on the brake rod, whereby the ends of the brake rods will be locked together automatically when the cars are coupled.

An improved boat detaching apparatus has been patented by Messrs. Edward J. Hill and Josiah L. Clark, of Westminster, England. This invention consists in constructing the hooks by which the boats are suspended with their upper or curved part swelled into V or horn shaped lugs provided with downwardly retreating faces, whereby the hooks are prevented from slipping through the rings, links, or shackles, and the latter are held in a forwardly inclined position.

An improved railroad signal has been patented by Mr. Joseph A. I. Claudon, of Titusville, Pa. The invention consists in a spring at the side of the rail, connected with a pawl adapted to act on a ratchet wheel in an underground box, which ratchet wheel is mounted on a shaft in a longitudinal underground box or tube parallel with the rails, which shaft is connected by means of right angled shafts and bevel cog wheels with one or more vertical shafts journaled in vertical frames carrying bells adapted to be sounded by spring hammers, which vertical frames are a greater or less distance from the spring. Every time a wheel depresses the spring the gongs are sounded, and the approach of the train will thus be signaled at stations, bridges, crossings, etc.

An improvement in locomotive driving gear has been patented by Mr. William Crippen, of Cadillac, Mich. This invention consists of a crank shaft ranging lengthwise of the locomotive, and located between the trucks and gearing with them by toothed wheels, the crank shaft having universal joints, and also having provision for sliding in the driving pinions on it in order to compensate for the deflections of the line and the variations of the length of the same, due to the curvatures and grades of the road. The crank shaft and transmitting gears are located in the longitudinal center of the locomotive to lessen the variations as much as possible. The object is to dispense with the expensive and complicated connecting rod and side bar gear and substitute a cheaper contrivance, and also to lessen the friction of the machinery.

MECHANICAL INVENTIONS.

An improved wagon rack has been patented by Mr. John Shafer, of Logansport, Ind. The object of this invention is to provide a wagon bed which may be converted at will into a rack for wood or a rack for hay.

An improved machine for drying calico has been patented by Mr. Francis J. Crowley, of Gloucester City, N. J. This invention relates to a novel construction for preventing escape of steam through the joints of the concentric drying cylinders, and for facilitating the removal of the calico from the outer cylinder.

An improved screen has been patented by Mr. Nicholas W. Godfrey, of Bayville, N. Y. This invention relates to improvements in revolving multiple screens, such as are used for separating sand or gravel into different grades, and it provides a revolving multiple screen that can be easily taken apart for repairs or for replacing any of the screens when they become worn out.

An improved pump has been patented by Mr. David E. Washburn, of Houghton, Mich. This pump dispenses entirely with pistons, plungers, plunger valves, packing, etc., and acts upon the respiratory or bellows principle. Its action is direct and without friction, and the pump, being entirely submerged in water, is proof against all injury from freezing.

An improved washing machine has been patented by Mr. Jonathan E. Hobby, of Omio, Kan. This washer is designed to be placed in a washtub and to be secured to the upper edges or sides. This washer employs a pair of grooved rollers between which the clothes are passed. One of these rollers is provided with a cam to give it end motion to secure a rubbing action.

Mr. William P. Miller, of Tipton, Mo., has patented an improved nut lock in which the plate to which the swinging plate is hinged is provided with two spring tongues having guide loops at the ends, between which a hinged joint on the swinging plate passes, this hinge joint being provided with a cam projection, by means of which and the spring tongues the swinging plate can be held in any desired position.

An improved track lifter and holder has been patented by Mr. Alexander C. Phillips, of New Castle, Pa. This invention relates to means for lifting the rails of railroad tracks, and holding them in position while tamping and filling under crossties, or when taking out old ties and putting in new ones; and it consists in a lever raising device and stand therefor of peculiar construction, and a notched holder for the lever.

Mr. Benjamin B. Powell, of Petoskey, Mich., has patented an improved mechanical movement used to convert rectilinear reciprocating motion into continuous rotary motion. It consists of a segmental cog wheel having a regular series of epicycloidal teeth with a large tooth and a notch at each end of the series; also, in two racks arranged parallel with each other and connected rigidly by end pieces and adapted to engage the segmental cog wheel in alternation.

An improved machine for rolling coupling pins has been patented by Mr. Frank A. Iddings, of Warren, O. In the operation of the machine, the iron rods, in length as required, are first heated and then fed in at the hopper, and by the revolution of the roll they are carried around between the roll and the interior surface of the bed, so that they are thus gradually rolled and pressed to the form and size required until discharged at the under side of the roll.

An improved saw sharpening tool has been patented by Mr. Robert S. Munger, of Mexia, Texas. This invention consists of a rotary tool having an annular rim or a curved rim, made either concentric or helical, and with one or both filing surfaces of the rim inclined inward from heel to edge toward the axis of the tool, whereby the rim is adapted to give to the face or face and throat of a saw tooth a smooth convex surface to prevent it from cutting or napping the lint.

An improved brick machine has been patented by Mr. John Owen Smith, of Savannah, Ga. This invention relates to brick machines having a wheel provided with moulds, in combination with eccentrically operated plungers and propellers for feeding the clay to the moulds. The machine will grind the clay as it comes from the bank, feed it into the moulds, press the bricks into the moulds, and eject them upon boards arranged on a traveling apron, by which they are to be conveyed to the kiln.

An improved dumping wagon has been patented by Mr. James M. Kimball, of Woodstock, Ill. This invention relates to a bottom made in two parts, divided and hinged along the center longitudinally between the axles to swing down from the outsides, with a lever and chain on each side of the wagon box to close the respective parts of the bottom, and another lever to work catches for fastening the bottom, which lever is also a catch for securing the closing lever.

An improved friction clutch has been patented by Mr. Henry James, of Hudson, N. Y. The object of this invention is to provide a simple, economical, and effective mechanism whereby driving pulleys or other wheels of machinery may be readily locked upon and released from their shafts while the latter are in motion. The invention consists in the combination with the wheel or pulley, and its wedge shaped bearing blocks and shaft, of a mechanism that is adapted to move the said bearing blocks longitudinally while the shaft is in motion, and thereby to lock or unlock the pulley upon its shaft.

An improved oiler has been patented by Mr. Edgar James Wells, of Hague, N. Y. This invention consists of the cup which contains the oil, contrived to revolve in the stem by which it is attached to the supporting device, and provided with means for slowly revolving therein to supply the oil by measures, the delivery of which is interrupted by the rotations of the cup and the quantity governed by a variable capacity of the measuring cavity, or it may be by the speed of the cup's motion, to be adapted to the requirements of the case.

AGRICULTURAL INVENTIONS.

Mr. William P. Brown, of Zanesville, O., has patented improvements in wheeled cultivator for which Patent No. 190,810 was granted May 15, 1877, to the same inventor.

Mr. William P. Gard, of Parsons, Kan., has patented an improved seed planter. This invention possesses several novel features which render it efficient and reliable, while permitting of great simplicity of construction.

An improved cultivator has been patented by Mr. Bradford A. Knight, of Beatrice, Neb. This is a novel arrangement of plows and plow beams permitting of a complete adjustment of the parts to the work to be done.

An improved land roller has been patented by Mr. Robert A. Horning, of Brookville, Ill. This invention consists in a novel arrangement of two cylinders, one working diagonally in advance of the other, a new framework to which the cylinders are connected, and in certain details of construction and arrangement of the hubs, axles, braces, and an adjustable seat.

Mr. David A. Yoakam, of Windham, Ia., has patented an improvement in corn planters. By the use of this improved planter the expense of furrowing the ground in advance of the planter by an extra hand is avoided, and by making one mark or furrow at the starting point will save the expense of the wire used by the check rower, also the trouble of moving the wire at every starting point.

Mr. William H. West, of Grand Island, Neb., has patented a cultivating implement which is adapted for several distinct purposes—that is, the preparing of land for grain and the cultivation of corn in all its various stages; and it consists mainly in the special construction of parts by means of which the implement is adapted to cultivate corn two rows at once; and in the combination, with the double cultivator, of a head block of special construction, by means of which the implement is adapted for preparing land for grain.

An automatic check row and drill attachment for corn planters has been patented by Mr. George Marple, of Osage City, Kan. This invention consists of an automatic attachment for working the dropping rod or slide of seed dropping apparatus or the check rower or drills, the same being a ratchet attachment to one of the driving wheels, and a sleeve with tappets to work the slide, and a shipper lever and spring to work the sleeve, combined in a simple and effective arrangement.

MISCELLANEOUS INVENTIONS.

Mr. Thomas I. Kennedy, of Wallingford, Vt., has patented an improved device for holding mops firmly in such a manner that they can be secured or removed very easily and quickly.

An improvement in dressing cases has been patented by Mr. George R Spear, of Brooklyn, N. Y. This invention consists in the peculiar construction and arrangement of parts. The invention comprises a wash stand and dressing case in a handy and compact form.

Mr. Lorenzo D. Clements, of Tallmadge, O., has patented an improved fence post provided with a series of openings along its edge for receiving each loop, having one arm pivoted to the post and adapted to receive and hold the rails by their weight.

Mr. Leonhard Roth, of Brooklyn, N. Y., has patented a calorific compound consisting of the following ingredients, combined about in the proportions stated, viz.: dry sodium, metaphosphate (natrum metaphosphoricum siccum), ten parts; dry sodium citrate (natrum citricum siccum), four parts.

Mr. Wilhelm Heussler, of New York city, has patented a method of making candy, consisting in melting nuts and sugar together, hardening, and then pulverizing the mass, and mixing it with sugar and cream that have been boiled together, whereby a dough is formed from which the candies or pellets are made.

An improved muzzle has been patented by Mr. Edwin Parker, of Council Bluffs, Ia. This device is inexpensive and thoroughly effective, while it does not punish the animal nor retard its growth. The muzzle is adjustable to fit the animal, as is required, on account of the variations in size, so that only two sizes are required—one for calves and the other for cows.

Mr. Arthur W. Brewtnall, of London, County of Middlesex, England, has patented an improved means of coupling branch wires to main conducting wires or cables (as required in the installation of electric lamps, for example), whereby the connections of the wires may be made and the insulation of the couplings effected with great ease and rapidity.

Mr. George W. Griswold, of Pottersville, N. Y., has patented a corkscrew formed of a screw attached to a block mounted to slide on the shanks of a U-shaped frame, which shanks have their ends bent upward and outward to form spring loops, which serve as a handle for the corkscrew, and which can also be used as key rings.

An improved removable wick tube for lamp burners has been patented by Mr. John Sweeney, of Sing Sing, N. Y. The invention consists in a wick tube cut open longitudinally to facilitate passing the wick into it. The wick tube can be passed into a fixed tube of a lamp burner, and can be locked by means of a slot in the fixed tube and a stud or projection on the removable tube.

Mr. Elijah M. Ames, of Pepperell, Mass., has patented an improved warming pan for warming beds. The invention consists of a flat hollow vessel having its edges beveled from the top and bottom, which vessel is provided with a tubular handle open at both ends, through which handle the steam of the hot water with which the vessel is filled can escape, whereby all moisture is be kept out of the bed. As the edges of the vessel are beveled, it can be passed under the covers or sheets without wrinkling or folding them.

Mr. John S. Jenkins, of Lima, O., has patented an improved device for chalking the chalk lines used by carpenters, masons, etc. The chalker is formed of two cylinders provided with outer conical ends, having an aperture in the end of each cone, which cylinders when united form a casing adapted to receive pieces of chalk, through which the cord passes, whereby the line or cord will be chalked by drawing it through the casing.

Mr. Henry Cordes, of Hoboken, N. J., has patented an improved bilge water valve for ships consisting in the combination, with a vessel's hull having an opening in its bottom, of a semi-cylindrical case fitting into the said opening, and having a plate attached to its lower end, a plug fitted into the said case and opening, and rack bars attached, one to the said bars and one to the said plug, and engaged by a pinion or gear wheel having a crank and itself engaged by pawls, whereby an aperture through the vessel's bottom can be opened and closed.

Mr. John A. Titzel, of Allegheny, Pa., has patented a new compound or mixture adapted for rendering waterproof any kind of cloth or fabric, or to be mixed with any kind of paint or varnish for rendering it tough and durable, or to be mixed with any pigment and used as a paint for covering metal or wood, or used in any place where a durable paint is required. It is formed of equal parts of raw resin oil and vulcanized rubber in solution, and mixed with one part of resin, a neutralizer for the sulphur and acid, and four parts of benzine.

A trap and overflow stop for wash basins, etc., has been patented by Mr. William D. Schuyler, of New York city. This invention is applicable to stationary wash basins, bath tubs, and other like structures, and relates to apparatus or devices in which the faucet that lets on the water in the basin or receptacle has combined with it a valve in or connected with a waste pipe, and which opens and closes with the opening and closing of the faucet for the purpose of preventing the escape of the sewer gas up the waste pipe.

An improved gate latch has been patented by Mr. Alfred C. Belt, of Aullville, Mo. This invention is designed to enable persons on horseback to conveniently open and close the gate without dismounting, and to prevent the lifting of the gate and the unlatching and opening it by hogs, which would allow them to escape from the inclosure. The invention consists of a gravity lever or latch arranged obliquely to the front edge of the gate, its shorter arm below its fulcrum and its longer arm above that point and operating in a guide, while its lower end is provided with a notch or beak adapted to engage a stud or catch on the gate post or other surface.

An improved fire escape has been patented by Mr. Elbridge J. Moore, of New York city. This invention relates to fire escapes for buildings in which folding ladders are used; and it consists in a self-adjusting folding sectional ladder of novel construction, designed to be attached to each story of a building, and is or may be made up of independent ladders or ladder sections that combined form a continuous ladder extending from roof to pavement, said sections being secured by hooks to a bar or window sill below, and by hooks to a window sill above. Thus applied, the ladder folds against the building, and when not in use is concealed from sight by a box, case, or cover, which may be of ornamental construction, and which is capable of being thrown open and the ladder being dropped into working position by the mere opening of a clasp or other simple fastening, the whole forming a perfect fire escape ladder free from objections of architectural disfiguration.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 5, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

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Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) M. G. F. asks: Can you inform me of the ingredients and the process for making soda water, so extensively used as a summer drink? A. Soda water, so called, is a solution of carbonic acid gas under pressure in water, and is evolved from a mixture of marble dust and oil of vitriol in a peculiar apparatus for the purpose. For the sirups used in flavoring this soda water, see SUPPLEMENT No. 77.

(2) A. B. C. asks whether it is scientifically true that there is an equinoctial storm? A. It is customary to call any general storm occurring any time within a month of the equinoctial passage an "equinoctial." It is only accidentally coincident with the sun's crossing of the "line." Sometimes the season passes without any "equinoctial."

(3) A. J. P. asks: Can water be drawn through a pipe two inches in diameter by a steam pump situated three thousand five hundred feet from the reservoir, and about twenty feet above its level? A. Yes, if the pipe is tight, but the supply of water will of course be much less than if the pipe was but a few feet in length.

(4) M. E. W. writes: I have a telescope with a 1⅝ achromatic object glass, focus about 25 to 30 inches with celestial eyepiece, power 146 times. In using it for star gazing, they look upside down. Could I attach a terrestrial eyepiece to remedy this, and could I see Jupiter's moons and Saturn's rings with the telescope, if I used a terrestrial eyepiece? If so, please let me know the size and power of eyepiece I would need, and if I could attach it to the one I have. A. If your telescope of 25 inches to 30 inches focus bears a power of 146 times, you ought not to complain of the objects being upside down, as all astronomers see them in that position, and get used to it. A terrestrial eyepiece will only magnify from 20 to 40 times in your telescope. You could, of course, have one fitted to your telescope which would do excellent work on terrestrial objects, but would lack brilliancy and power on celestial objects; would show Jupiter's satellites, but would not give satisfaction with Saturn.

(5) T. P., Kansas City: All brook and mountain trout, both Eastern and Western fish, have scales.

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MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

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A Knabe in the White House.

(From the Baltimore American.)

There was seen yesterday at Messrs. Knabe & Co.'s factory a magnificent concert grand, just finished by them for the presidential mansion. President Arthur, who is a thorough connoisseur of music, in selecting a piano for the White House decided in favor of the Knabe Piano as his preference, and ordered accordingly the instrument referred to. It is a concert grand of beautiful finish in a richly carved rosewood case, and of superb tone and action—an instrument worthy in every respect of the place it is to occupy. It was shipped to its destination yesterday.

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The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 84 John St., New York.

For Sale, or Exchange for Drill or Shaper, Engine 8x12 in. & Bed Stones. W. J. Sanderson, Syracuse, N. Y.

Scientific Books. See page 396. Catalogues free. E. & F. N. Spon, 44 Murray Street, N. Y.

Patents for sale. Henry Stinson, Scandia, Kansas.

Lehigh Emery Wheels can be adapted to all kinds of work, and for rapid cutting and durability are unexcelled. Write for prices and discounts. Lehigh Valley Emery Wheel Co., Lehighton, Pa.

Otis Passenger Engine & Safety Drum, Cylinders 8x10, Double Cut Gears, in good condition. L. S. Graves & Son, Rochester, N. Y.

H. W. JOHNS' ASBESTOS AIR CHAMBER COVERING, consisting of Asbestos Sheathing or Lining Felt, combined with Hair Felt, for Steam Pipe and other heated surfaces, is patented, and infringers will be prosecuted to the full extent of the law.
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American Fruit Drier. Free Pamphlet. See ad., p. 398.

Am. Twist Drill Co., Meredith, N. H., make Pat. Chuck Jaws, Emery Wheels, Grinders, automatic Knife Grinders.

Fire Brick, Tile, and Clay Retorts, all shapes. Bornerg & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Peck's Patent Drop Press. See adv., page 396.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Brass & Copper in sheets, wire & blanks. See ad. p. 397.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 15,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Lubricator. See advt., Detroit Lubricator Co., p. 398,

Eagle Anvils, 10 cents per pound. Fully warranted.

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See New American File Co.'s Advertisement, p. 398.

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Steam Pumps. See adv. Smith, Vaile & Co., p. 398.

Trevor's Patent Key Seat Cutter. Trevor & Co., Lockport, N. Y. See page 396.

Engines, 10 to 50 horse power, complete, with governor. $250 to $550. Satisfaction guaranteed. More than seven hundred in use. For circular address Heald & Morris (Drawer 127), Baldwinsville, N. Y.

Brass Finishers' Turret Lathes, 13½ x 4, $165. Lodge, Barker & Co., 189 Pearl St., Cincinnati, O.

Important to Inventors.—The Anglo-American Patent Development Company, Limited, 28 Southampton Buildings, London, England, Authorized Capital $250,000, is prepared to receive applications from American Inventors to develop (by manufacturing or otherwise) their inventions in Europe. Full particulars addressed as above by Registered Letter to be forwarded, with $5.00 U. S. Currency, to cover expense of investigation, otherwise applications cannot be considered. Inclose stamp for Prospectus of Company to Messrs. Knauth, Nachod & Kuhne, Bankers, New York.

Thomas Camp, of Covington, Georgia, General Agent for the sale of Portable Steam Engines, has a trade of $250,000 per annum in that State. Manufacturers will find this the best medium in the South through which to sell such goods. None but first-class engines sold. Best of reference given and required.

Curtis Regulator, Float, and Expansion Trap. See p. 364.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 382.

The Sweetland Chuck. See illus. adv., p. 382.

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Cope & Maxwell M'f'g Co.'s Pump adv., page 366.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 364.

Red Jacket Adjustable Force Pump. See adv., p. 366.

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Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users & engineers. (Forward above by postal or letter; mention this paper.)

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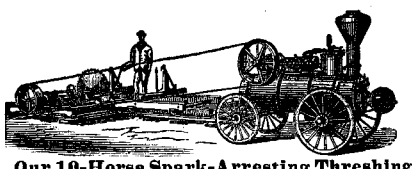

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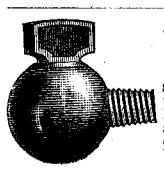

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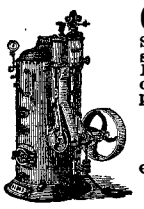

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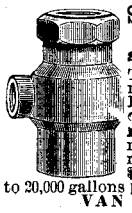

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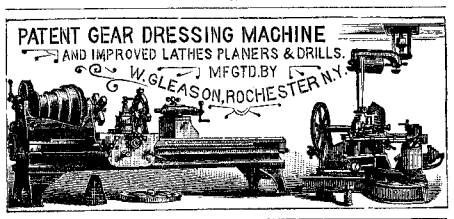

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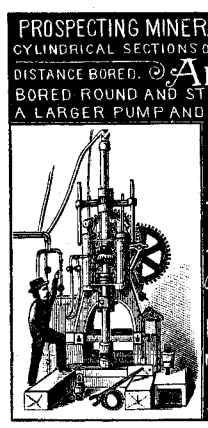

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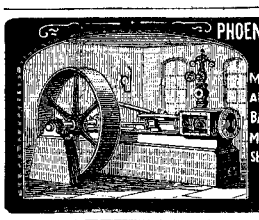
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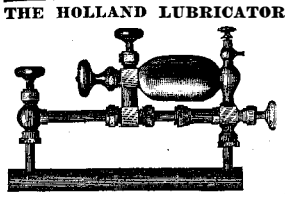

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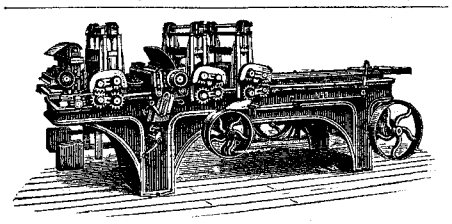

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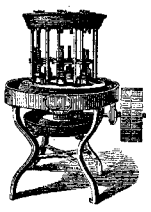

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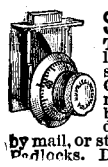

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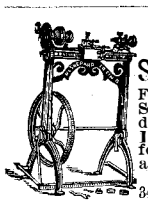

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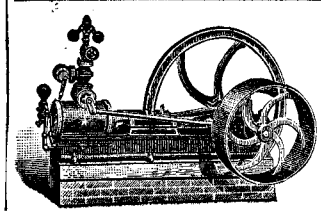

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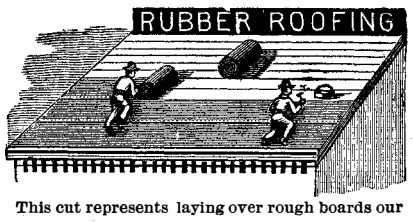

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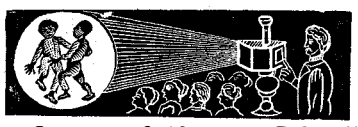

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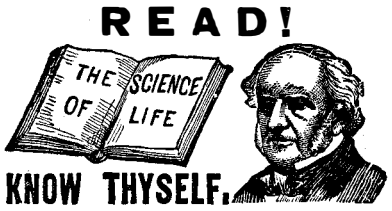

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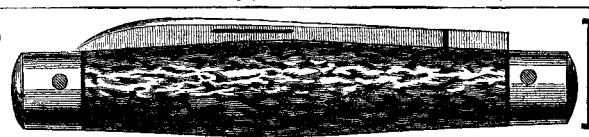

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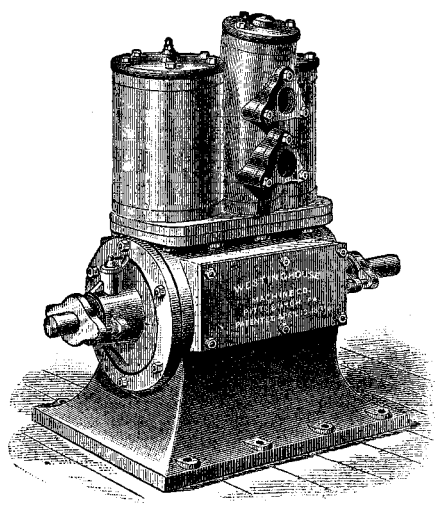

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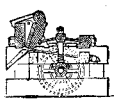

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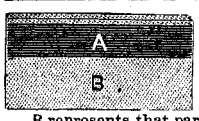

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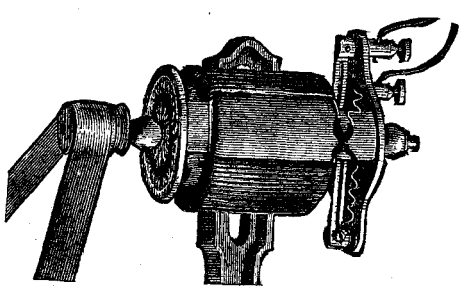

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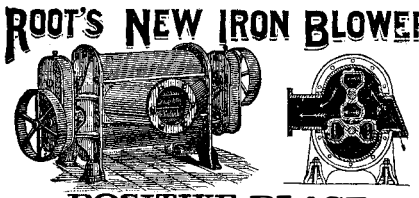

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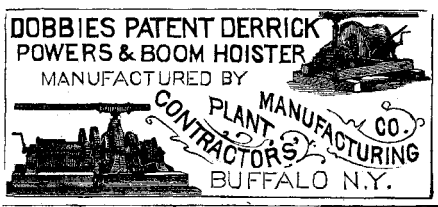

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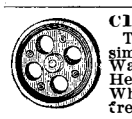

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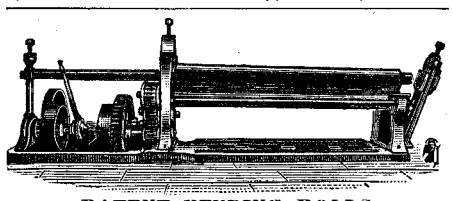

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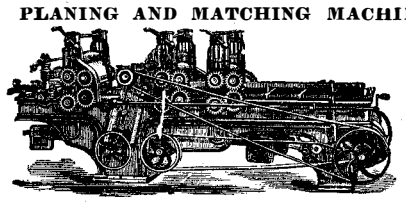

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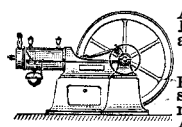

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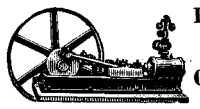

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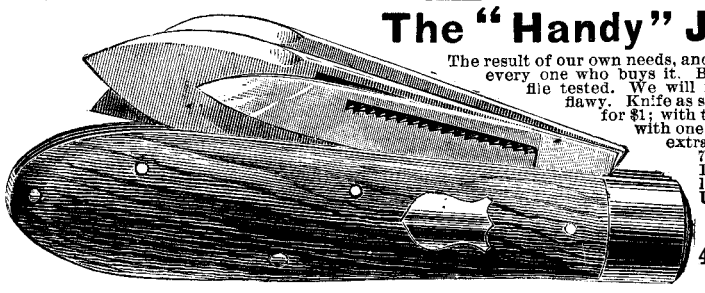

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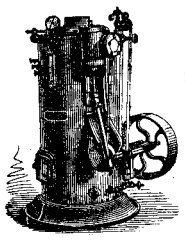

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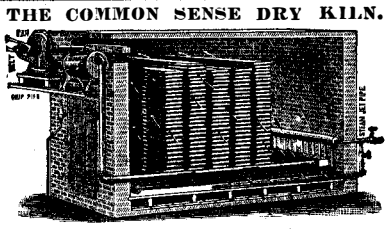

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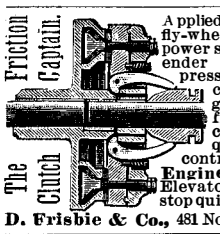

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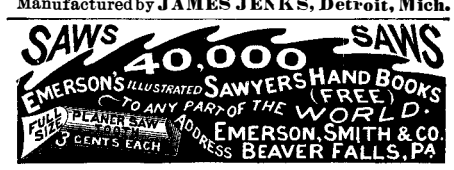

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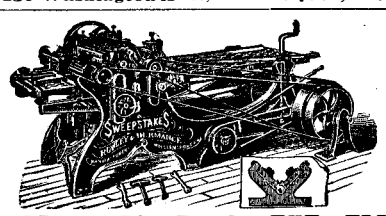

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